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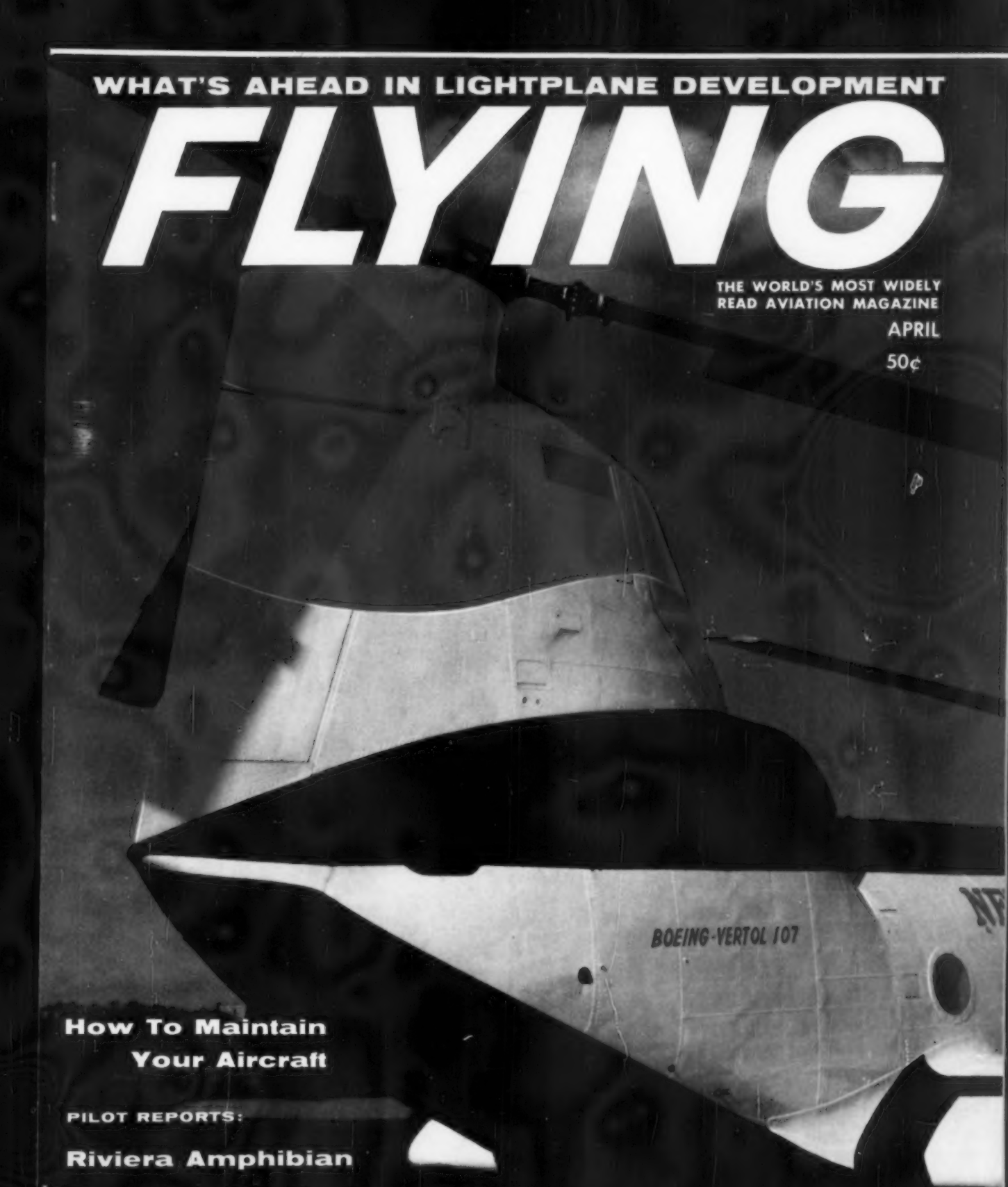

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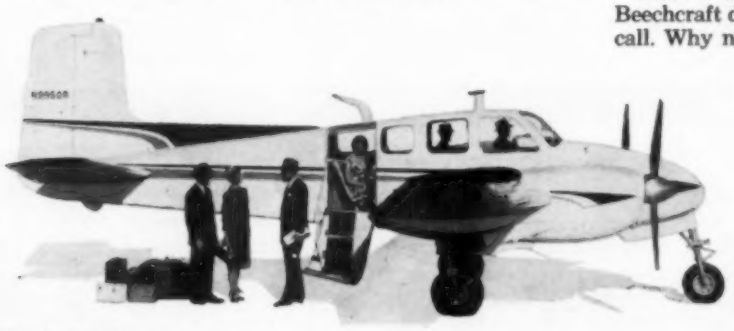

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APRIL, 1961

VOLUME 68, NUMBER 4

COVER: The big vertical fin is a hallmark of the Boeing-Vertol 107 (see page 26). The 25-passenger prototype is powered by twin turbines, has amphibious capability. New York Airways has ordered an initial fleet of five, for 1961 delivery. Photo by Dick Weeghman.

CONTENTS

LIGHTPLANES OF THE FUTURE **22** *J. S. Butz Jr.*

A voice from the days ahead tells unusual engines, performance, designs

PILOT REPORT: TWIN-TURBINE VERTOL 107 **26** *A. C. Bass*

This fast-stepping new rotorcraft gives high performance on land and sea

CANADA'S SMALL GAS TURBINE—THE PT6 **28** *Robert I. Stanfield*

A new lightweight engine is built to power fixed- and rotary-wing craft

PILOT REPORT: RIVIERA AMPHIBIAN **32** *Vico Rosaspina*

Italy's import combines ruggedness and efficiency in an unusual package

MITCHELL'S AUTOMATIC PILOT **35** *Richard B. Weeghman*

Solo IFR is much less demanding when you fly with this mechanical copilot

MAINTENANCE AND THE PILOT **36** *Roger D. Palfrey*

Want to fix your own airplane? You can, when you make one special friend

PILOT REPORT: TRANS-FLORIDA'S CAVALIER 2000 **38** *Richard Bach*

The P-51 Mustang is back in the air as a swift, far-flying business plane

JET GROWTH MARKS ARMY AVIATION **40** *Lou Davis*

Army's search for better mobility includes a look for its own jet fighter

THE MENACE OF PILOT VERTIGO **43** *John T. Flynn, M. D.*

When IFR, beware the false information your senses would have you believe

NEW MEXICO'S HAVEN OF GENERAL AVIATION **44** *George Mason*

Crushed by heavy air traffic, Albuquerque built an airport for lightplanes

SPERRY, INDUSTRIAL GIANT OF THE AIR AGE, PART IV **46** *Gill Robb Wilson*

Through turbulent years, a second war, and new air commerce, Sperry grows

THE PRO'S NEST: BY THE LIGHT OF THE MOON **48** *Ted Durosko*

Flying in the dark is not difficult, only different. Some tips for pilots

FLYING SAFETY IN THE AIR FORCE **50** *Maj. Gen. Perry D. Griffith*

In a peacetime Air Force, the big war is waged against aircraft accidents

FLYING REPAIR SHOP **54** *Robert A. Latimer*

Servicing refrigerator trucks by airplane is as profitable as it is unusual

FLYING FEATURES

Mailbox 4
Briefings 8
New Products 10
Who and Where 12
Have You Read? 16
Airman's World 30
Picture Credits 98

EDITORIAL 20

Flying Newsreel 52
I Learned About Flying From That 56
Thrust Lever 58
Hangar Flying 98
Flying Calendar 102
Advertising Index 111

TIME FOR A CHANGE. People in this flying business say the time is ripe. And so do we; our feelings are reflected in this month's page 22 article. This year, we feel, marks the beginning of a decade of growth; of better things to come. In this and successive issues you'll find this progress that also marks FLYING magazine.

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Branch Offices: 434 South Wabash Ave. Chicago 5, Ill.
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WINGS and THINGS

TURBINE-POWERED BARON? Beech and SFERMA of France planning a joint production program combining the new Baron airframe and Turbomeca A turboprops. The five-place Baron, currently powered by two Continental IO-470-L 260-hp fuel injection engines, has a top speed of 230 mph and lists at $58,250. Planned price of a 300-mph-plus turbine version is reportedly $80,000. Two prototypes may fly at the late-May Paris Air Show; Beech is considering U. S. production in 1962.

BUSINESS-PERSONAL AVIATION, *long a second-class citizen in England, now being spurred by the Ministry of Aviation. New ruling now allows single-engine, privately owned aircraft to land at London Airport, provided the aircraft is radio-equipped, the pilot is instrument-rated, and prior permission has been obtained. Airport was restricted to commercial, multi-engine aircraft.*

FIRST CONTROL TOWER installed by a government agency at a privately owned field is nearing completion at Addison Airport, Dallas. FAA has installed equipment; the tower is expected to be opened on May 1.

JET FLYING HOURS *under active study by the FAA, which is considering flying time limitations that would affect airline jet crews. On the military side the Air Force, for instance, has conducted extensive tests that have pointed up the fatigue effect of jet flying.*

"TALKDOWN SERVICE" for VFR pilots caught on top of overcasts is also being considered by the FAA. In "Project Talkdown" tests completed at this writing, 97 per cent of the letdowns attempted by 54 lightplane pilots in simulated IFR conditions were successful. Procedure, tied to instructions of ground operators, consists of trimming aircraft straight-and-level on top of overcast; reducing power to maintain a 500- to 1,000-fpm rate of descent; maintaining a single heading with rudder only until VFR under the overcast. Talkdown would be utilized with ceilings of 1,000 feet or more; require two-way radio and magnetic compass.

CANADAIR 540 *official modification center expected to be set up at the Utica, N. Y., facilities of Mohawk Airlines, which at this writing has been concluding negotiations with Canadair Ltd., a General Dynamic Corp. subsidiary. Stateside customers of the twin-turboprop—a blend of the Convair 440 airframe and Napier Eland powerplants—will be offered interior servicing.*

SCHWEIZER AIRCRAFT to produce a two-place, all-metal, high-performance sailplane to train and check out rated power-pilots. Designated the 2-32, of which prototype will fly this spring, aircraft will seat two in tandem (rear occupant seated highest) and utilize a full-length plexiglas canopy and speed-limiting dive brakes. Cost: something over $4,000. Kit also will be available. Present trainer is two-place high-wing SGU 2-22C glider, tailored to the beginner.

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CONTRIBUTIONS: Contributions should be mailed to the New York Editorial Office at One Park Avenue, New York 16, N. Y., and must be accompanied by return postage. Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions will be handled with reasonable care; but the magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's and contestant's rights, title and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

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FLYING is published monthly by the Ziff-Davis Publishing Company, William B. Ziff, Chairman of the board (1946-1953), at 434 South Wabash Ave., Chicago 5, Ill. Second-class postage paid at Chicago, Ill. Authorized by Post Office Department, Ottawa, Canada, as second-class matter.

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IT'S CURTAINS IN 1½ MINUTES!

Flying above 18,000 feet you must have oxygen or lose consciousness in minutes depending on your physical condition. At altitudes between 10,000 and 18,000 feet your field of vision narrows. In fact, the armed forces require all flyers to breathe oxygen when flying above 10,000 feet in daylight or above *5,000* feet at night.

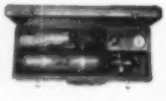
And yet, high altitude flight opens up a whole new standard of flying. It's comfortable . . . smooth. Up where the air is thinner you get better speed and longer range. Engine performance improves. You can avoid bad weather by flying higher where the sky is clear and blue. That is, you can if you have the proper oxygen equipment.

Take time to learn more about the physiology of flying. The operating altitudes of private aircraft have steadily increased. They are no longer limited to altitudes below 10,000 feet as most of them were in the past. Present trends to higher flight altitudes will continue. In the next ten years we can expect service ceilings in the neighborhood of 30,000 feet.

Unless suitable oxygen equipment is in the aircraft and convenient for use, we face the increasing possibility that such planes may at times be flown by pilots whose mental and physical capabilities have deteriorated. This could result from prolonged exposure to altitudes above 10,000 feet or by short exposure to altitudes still higher.

Today, oxygen equipment is so light-weight and inexpensive there is no reason for a flyer to deny himself the advantages of high altitude flight. If you would like to fly the high road and are interested in the types of oxygen equipment available, a letter to Regis Stevenson, Scott Aviation Corporation, Lancaster, New York, will bring you complete information.

HERE'S FLYING PLEASURE and BREATHING SAFETY



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MAILBOX

THE ELECTRA

. . . Have just read Lou Davis' article "Electra on Public Trial" in February FLYING. As one in the midst of the melee, I would like to say that it is a piece of the clearest writing on a controversial topic to come along in some time.

The Electra is a great airplane. Anyone who knows her surely could not contest this statement. It is my hope that your widely read magazine will bring the truth to all who read it.

I am certain, that with the strength the Electra has demonstrated, it will be as Gill Robb Wilson wrote in the Lockheed Story, 'Electra in perpetuity.'

ROBERT BOGASH
New Rochelle, N. Y.

. . . The Lockheed Electra, victim of malicious slander by thoroughly uninformed armchair pilots, is undoubtedly one of the finest aircraft flying today. It is performing beautifully and proving itself a thoroughbred in every respect . . . engineering, passenger comfort, ease in handling, dependability and safety. The structural failure of the two Electras is indeed unfortunate, but because of these failures the aircraft should not be condemned by the general public as it is . . . Perhaps those who distrust the plane will eventually realize that it is a tremendous piece of machinery and worthy of all praise bestowed upon it.

JOHN T. WIBLE, USAF
727th AC&W Squadron
Myrtle Beach AFB, S. C.

I have been reading your magazine steadily for the past three years and enjoy it immensely. I am 15 years old and, at present, receive it by subscription.

I thoroughly enjoyed the article in the February 1961 issue, entitled "Electra on Public Trial." I see no reason why anyone can criticize such a near perfect aircraft. Though only fifteen, I have flown on many airliners; Martin 404, Convairs 240, 340, 440; Douglas DC6, DC6B, DC7's; Fairchild F-27 and my favorite, the Lockheed Electra. I find it the smoothest, fastest and most comfortable of them all. My brother, a flying executive, says if there is an Electra flight toward his destination, he will take it, even though there are jet flights to his destination.

If I could, I would shake the hand of every man who made the Electra possible.

As long as there is an Electra flying, I will fly on it despite anybody else's comments.

VAUGHN HATT
Woodmont, Conn.

GET THE MOST FROM THE WEATHER BUREAU

The article in your February, 1961, issue "Get the Most From the Weather Bureau," by Jack LeBarron is at once one of the most interesting and most logical presentations of its kind we have seen. Jack LeBarron has written so clearly what Weather Bureau briefers and forecasters can heartily endorse, and with the authority of one who uses the service rather than provides it.

We strongly recommend the article to all pilots who have access to a Weather Bureau office, and would like to see it reproduced in such form that every pilot could obtain a copy. Use of the recommended systematic approach will enable young pilots to become old pilots, and all pilots to exploit to the fullest the service that is available.

A. J. KNARR, Meteorologist
Amon Carter Field,
Ft. Worth, Texas.

AGRICULTURAL AVIATION DOWN UNDER

In the copy of FLYING, August 1960, you published an article on agricultural flying. You have a photo on page 23 identifying the Cessna aircraft as a 170 model. I'm fairly certain it is a 180 loading fertilizer on an airstrip in Taranahi, New Zealand, note Mt. Egmond, one of our landmarks in the background.

Aircraft here drop hundreds of thousands of tons of fertilizer on New Zealand farmlands annually. The topdressing fleet consists mainly of Cessna 180's, Fletchers, Piper Super Cubs, Piper Pawnees, deHavilland Beavers plus several DC-3's and Lockheed Lodestars.

Here in the center of the North Island we use Cessna 180's mostly; and they do a marvelous job of topdressing and supply dropping from air strips averaging perhaps at most around 400 yards.

Our national economy here is based on our agricultural and pastoral production. Without the aid of these agricultural aviation operators, our national income would be a great deal lower and it seems they have become an essential part of our New Zealand farming.

DAVID W. GIBBS
Utiku, North Island, N. Z.

● *Quite right, the plane is a Cessna 180. Thanks.*—ED.

. . . I work for a crop dusting firm here in Cootamundra. We have two Fletcher FU-24's; one deHavilland Tiger Moth and a Cessna 180. Also we have another Fletcher on order, as well as an Edgar Percival 9.

Was also pleased to read in the previous issue (July) about Cessna in the "Soaring Sixties." In Cootamundra we have a Cessna 150, 172, 182 and Cessna Skylane . . . A person in town imports the Cessnas (second hand) from America and sells them here in Australia.

PETER HALL
Cootamundra, New South Wales.

THE WEEJET POWERPLANT

. . . The Weejet story by the Illings (February issue) was reminiscent to us, having furnished the powerplant for Harold Dale's and Ed Gagnier's jet airplane, as the story pointed out. However, certain facts stated in regard to the J69 engines, while true at the time of the Weejet program are now obsolete and should be brought up to date.

Volume production of the J69 since 1956 when the Weejet was flying has brought current Continental J69 engine prices down to the "ballpark" area of $15-18,000 in-

(Continued on page 6)

The TACTAIR T-3 is the only autopilot FAA-approved* for single-engine operation in twin-engine business planes.

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MAILBOX

(Continued from page 4)

stead of the suggested $30,000 figure.

So that readers of the article don't embark on a mass hunt of surplus J69 engines on the market, we should also inform them that there was no engine replacement program as such in the T-37 program. The T-37A airplane was equipped with J69-T-9 engines rated at 920 pounds thrust. The improved T-37B now in use utilizes J69-T-25 engines of 1,025 pounds thrust. T-37A aircraft have all either been or are being modified to "B" configuration. Likewise the long life characteristics and similarities between –9 and –25 engines made it possible for Continental and the USAF to modify and overhaul all –9 engines to the latest –25 production configuration at considerable dollar savings to the USAF. Consequently, there is no "quantity" of surplus J69 engines available. Incidentally, both engines have been certificated by FAA. The commercial identification for the J69-T-25 is CJ69-1025.

L. S. Matthews
Continental Aviation & Engineering Corp.
Detroit 15, Mich.

THE BIRD CAGE PARASOL

I have read with considerable interest the article under the above title by Henry Palmer Jr. in a recent issue of Flying. It certainly brought back memories of how I used to sit or play in one of the Santos Dumont "Demoiselle" airplanes. This was owned by my late father Edward H. Lanier . . . who purchased the airplane from Santos Dumont and had it shipped from Paris, France to the Cincinnati, Ohio area . . . the "Demoiselle" was my "hot rod" . . .

As far as I know this was the first airplane in this section of the United States, although prior to buying the "Demoiselle," my father had built an airplane in his own cone machine manufacturing plant in Cincinnati about 1907. Wilbur Wright came down from Dayton to see it and said that it would fly. This airplane was never flown though, as a suitable power plant could not be obtained.

The Flying article about the "Demoiselle" which was the "world's first lightplane" made me think and wonder all over again . . . to the great difference in the number of sales of private automobiles and private lightplanes up to the present day. We all know there were very few automobiles and airplanes at this early period. Percentage-wise there is no comparison today between the many millions of automobiles and some 100,000 lightplanes . . . The spread is so great it shows a deep seated fundamental disease in the private air vehicle . . . a disease the "doctors" wanted to ignore . . . They still do!

In the 1920's my father and I reached the same conclusion: the conventional airplane design with its aerodynamic safety limitations would *never* appeal to the masses . . . Today I am more convinced than ever and there are many others now sharing this view. Under average conditions, the pilot should be safe due to his airplane, and not vice versa. . . .

It is my belief that actually the "Air Age" is just beginning in the '60's. A vast world market is waiting . . . for new forms of safe, practical, low cost personal transportation. . . .

I also wish to compliment you and your staff on the continuous improvements you have made in Flying. It is an excellent and most interesting magazine today.

Edward M. Lanier, President
Lanier Aircraft Corporation
Marlton, N. J.

A PLEA FOR COURTESY

I had just taken off in my Cessna 175 from Oklahoma City's downtown air park and was climbing on a heading of 160 degrees to 3,500 feet for my trip back to Ardmore. As I reached 3,000 feet with my nose still high in my climb I noticed a Cessna 310 which had dead aim on my craft, not more than a mile away.

To avoid losing sight of the 310 I lowered my nose. In order to alter my course from that of the fast-approaching 310, I immediately made a 90 degree to the right and saw that this maneuver was not going to clear me from his path. Glancing back to the 310, I noticed he had not changed course in any manner . . . My only alternative was to reach for the fire wall in hopes my 175 would leap out of the way of the charging 310.

The rate-of-climb indicator jumped to 1,200 feet per minute just long enough to get 25 feet above the 310 which then sailed past me like a bullet.

I don't know whether the pilot saw me or not. I assume he didn't see me. I have just one request—a matter of common courtesy, not to mention the safety angle, that if I meet head-on with another pilot I do hope he will remember some of his CAR and alter his course to the right to avoid collision, and to signify to me that I have been observed. Believe me that was the longest 30 seconds of my life!

John G. Elmore
Tesco Engineering Co.,
Ardmore, Okla.

ON COURSE

I am a high school senior, graduating in May. I want to fly more than anything else in the world. I realize that aviation has become a great industry, with an incalculable future . . . I do not have to explain the feeling I have, because I am sure you have had the same feeling, as expressed by "The Airman's World."

During high school, I have taken all the math courses available. Extra-curricular activities include . . . nine years as a music student. I hope to attend college for two years and then enter the Navy or Air Force Aviation Cadet program. I realize that all of us can't be pilots, and if I fail to qualify, I will try engineering . . . making one of these branches of military service my career. The words of our new President ring in my ears. "Do not ask what America can do for you, but ask what you can do for America."

If you have any advice which would be of help to me, it would be welcomed with great appreciation.

Billy Hugh Weaver

● *Dear Lad: Just don't ever change.*
—Gill Robb Wilson, Publisher

NEW 90-GALLON

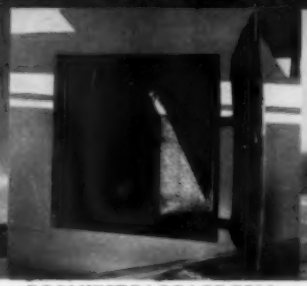
FUEL CAPACITY gives the new 1961 Comanche 250 over 1100-mile range at maximum cruising speed; over 1600 miles (12 hours) at economy cruise. Two optional 15-gallon internal wing tanks supplement standard 60-gallon capacity without taking up baggage space. No plane in its class matches the Comanche's fuel capacity, or provides such a safe fuel reserve. Comanche 250 is now approved for 100-pound increase in gross weight, too.

NEW PANEL WITH CENTER-MOUNTED RADIOS accommodates full IFR flight instruments plus 2½ comm/nav system including 2 VHF transmitters, 3 VHF receivers, 2 VOR/ILS LOC systems plus Piper AutoNav radio compass or ADF—and there's room left over!

NEW DUAL BRAKING SYSTEM offered exclusively as standard equipment. Provides individual toe brakes for left seat pilot plus handbrake accessible to either front seat occupant.

ALL THESE SUPERIOR COMANCHE FEATURES

EXCLUSIVE STABILATOR reduces drag 25%, increases stability, provides better low-speed control. Much imitated swept rudder adds eye-catching beauty.



ROOMIEST BAGGAGE COMPARTMENT in its class. With 20″ x 20″ door, 20 cubic-foot capacity, Comanche easily loads, carries up to 200 lbs. of luggage.

LARGE NOSE WHEEL, same size as main wheels, lets Comanche operate from rough, soft fields with greater safety than other airplanes in the same class.

ADJUSTABLE, RECLINING SEATS, just one of many superior comfort features of the Comanche's cabin, roomiest by far of any airplane in its class.

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Fly the Comanche
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See the 1961 Comanche at your Piper dealer's,
or write for Comanche brochure, Dept. G-4, **PIPER** Aircraft Corp., Lock Haven, Pa.

BRIEFINGS...

One of the major attractions of the 1961 Chicago International Trade Fair, July 25-August 10, is to be the International Aviation exhibit. Sponsored by the Chicago Assn. of Commerce and Industry (30 W. Monroe St.) the fair this year will be held at the new $35 million lakefront exposition

hall and grounds, facing across the water toward Meigs Field, shown here. Outdoor exhibit space has been allocated for business aircraft, which can be taxied directly from Meigs. Paul Butler, president of Butler Aviation, Chicago, and Merrill Meigs, are among the aviation exhibition sponsors.

Business and personal aircraft retail sales in 1960 reached a record high of over $200 million, exceeding by some $30 million the 1959 total, according to latest report from AIA's Utility Airplane Council manager, Joseph T. Geuting Jr. Unit production in 1959, however, was 7,689 airplanes as against 7,588 in 1960. Credit for the 1960 record retail sales value is given to the greater number of twin-engine aircraft delivered (1,255 in 1960 over 955 in '59), and because the aircraft delivered carried more instruments and navigation-communications equipment.

The Air Force, in accordance with a Department of Defense directive, has awarded a contract for 30 Boeing C-135A jet transports and 23 C-130B and E Hercules turboprop transports from Lockheed for the Military Air Transport Service. Initial delivery of the Boeing C-135A's—cargo version of the USAF jet tanker KC-135—is scheduled for June 1961. The Boeing contract involves about $90 million; the Lockheed contract about $35 million additional.

According to a national airport survey just completed jointly by the Airport Operators Council, American Assn. of Airport Executives and National Assn. of State Aviation Officials, airport needs in the U. S. will cost over $1.1 billion during the next four years. The survey was made on a state-by-state and airport-by-airport basis. Its findings are to be presented to the Kennedy Administration and to the Congress.

Mercury astronaut, Leroy G. Cooper Jr., awaiting a chance at outer space travel, recently purchased a Beechcraft Bonanza for more conventional travel in connection with his astronaut training, which requires extensive travel to various centers involved in Project Mercury. Purchase was made through Atlantic Aviation, Philadelphia,

Pa., where Cooper (in cockpit) took delivery from M. F. Mahoney, Atlantic's sales manager. Cooper's wife, Trudy, is also a licensed pilot and, with their two young daughters, the Cooper family will undoubtedly find many uses other than meeting training schedules for their Bonanza.

Santa Monica Steps Forward. To meet present demands and projected challenge of the booming General Aviation industry, the City Council of Santa Monica, Calif., has approved first steps toward the development of a "Sky Commerce Center" at the airport which in total will reach $25 million expenditure. The initial phase of the project, to cost an estimated $2 million, will include a control tower, terminal building, office building, restaurant, motel facilities.

Link Luckett, noted for his helicopter rescue last May of two mountain climbers trapped at the 18,000-foot level of Mt. McKinley, Alaska, has been selected for the Carnegie Silver Medal for heroism. The Arkansas-born, 33-year-old Luckett made six land-

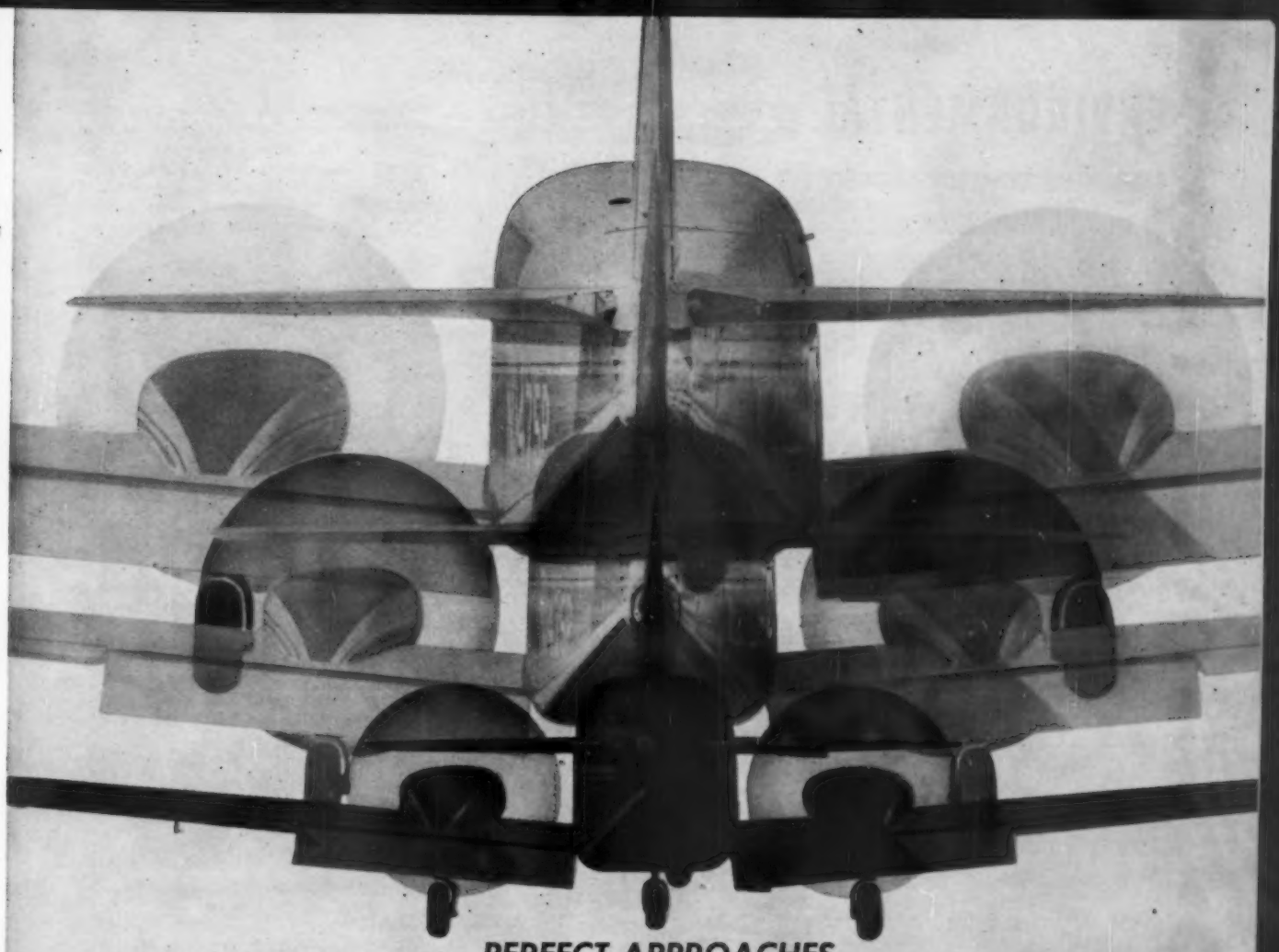
ings and takeoffs from the 18,000-foot altitude in a Hiller 12-E to make his spectacular rescue missions. Now president of HILL-I-COPTERS, helicopter charter firm in Anchorage, Luckett at the time of his record-making flights was a pilot for Delta Engineering Co., of Houston, Tex.

Republic Aviation, manufacturers of the WW I P-47 Thunderbolt, is broadcasting its desire to commemorate the 20th anniversary of the famed "Jug" on May 2, 1961. If enough of the old-timers who flew this airplane check in with the company, an appropriate birthday program will be arranged. Co-chairmen of the program committee are Robert S. Johnson, second-highest scoring living Ace of WW II, now with Republic, and L. L. Brabham, who flew the Thunderbolt on its maiden flight. Address them at P. O. Box 268, Farmingdale, L. I.; name your outfit and give brief resume of combat experience.

Uniform standards for identification marks on fixed-wing aircraft, adopted recently under Amendment 1-4 of the Civil Air Regulations, require markings at least 12 inches high on the fuselage, or vertical stabilizer. Previous regulation required marks on the right upper and left lower wing surfaces, and smaller marks on the tail. An optional rule (412-B) in effect since 1955, permitted omission of wing marks, if markings on tail or fuselage were at least 12 inches in size. Aircraft marked accordingly meet the new requirement, which becomes effective January 1, 1962.

Sponsored by the Arizona Flying Farmers, 54 members of the 25th Arizona Legislature in January enjoyed a three-day aerial inspection tour of their own state. Flying in 21 airplanes piloted by Flying Farmers, the group took off from Phoenix Sky Harbor Airport following a criss-cross course around the state, stopping off at 14 communities with overnight stays at two: Flagstaff and Tucson. At each stop well-arranged programs by local groups awaited the legislators. The purpose of the tour (so successful that it is now planned as an annual event) was three-fold: (1) to familiarize the law-

(Continued on page 112)



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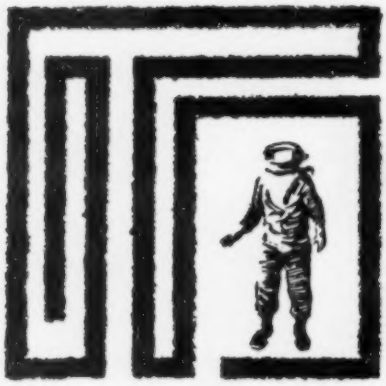

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BREATHING LIFE INTO AIR AND SPACE TRAVEL

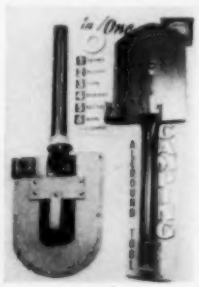
NEW PRODUCTS

Fli-Lite aircraft skis for tricycle geared airplanes, now produced by FluiDyne Engineering Corp., Minneapolis, Minn., feature new patented full conversion "wheel to ski" for the nose gear. All skis are hydraulically actuated from the cockpit during

flight, taxiing or when parked. Sliding load transfer plate moves beneath all three wheels, fully closing ski bottom to provide maximum ski surface. Fli-Lite Tri-Cycle skis meet FAA and Canadian Department of Transport requirements.

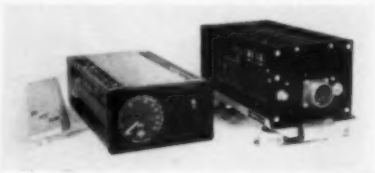
An aircraft position light flasher less than one pound in weight yet capable of handling an incandescent lamp load from one to five amps. at 28 volts DC is the latest from Aircraft Instruments Co., Radnor, Pa. Of solid state design, the unit flashes at 85 cpm, plus or minus five cycles, and, being completely encapsulated, is stated to be impervious to fuel, hydraulic fluids or similar elements. Price, according to the company, is low compared with the electromechanical type flasher.

For pilot's emergency kit, or general outdoor usage, Designs Modern (Box 4111) Carmel, Calif. offers this all-around robust tool of foreign make (Solingen) in the U.S. for $5.95. Called the "6-in-One", this implement is a spade, a hatchet, saw, hammer, nail extractor or can opener. In protective sheath, its overall length is 16 inches; weight, one and one-fourth pounds.



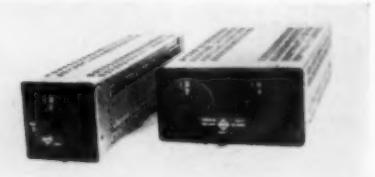
Designed primarily for life raft operation, but with battery modification applicable to private and corporate aircraft use, Hycon Mfg. Co., Pasadena, Calif. has announced a four-and-one-half pound self-contained radio locator beacon powered with a water-activated battery. Designated the Hy-Marker III, the beacon is released automatically upon raft inflation. The spring-loaded antenna erects and locks in place as water enters battery compartment and transmission begins immediately on an emergency wave length. Model IIIB gives 24-hour operation.

Distance Measuring Equipment (DME) for private and business aircraft is now available from National Aeronautical Corp., Fort Washington, Pa. Narco's Model UDI-2 DME, weighing 14 pounds, is a standard "Mark-size" panel mounted unit (center) with frequency selector plus distance in-



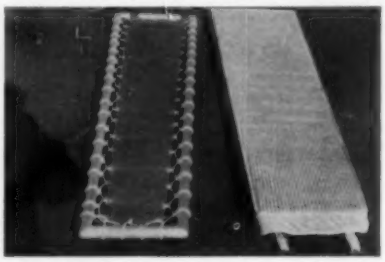
dicator, with range up to 100 miles, to give the pilot continuous indication of his slant distance from Vortac or ILS runway. It is crystal-controlled in same manner as a late-model VOR receiver and has 100 channels (108-117.9 mc). Remotely installed power supply is shown at right; small antenna at left. The price: $2,250.

Two new radios are also in production at Narco: the Mark 7 (left) providing two-way VHF communications on 360 channels with 50 kc spacing between 118.00 and 135.95 mcs; and Mark 10 (right) which combines a 360-channel transceiver, similar to the Mark 7, plus a separate 190-channel crystal-controlled receiver (right-

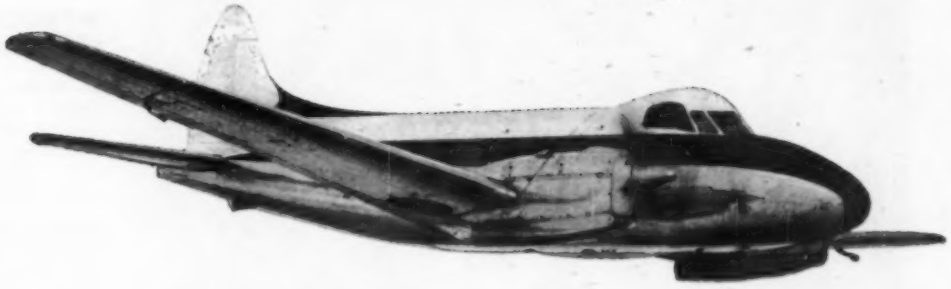


hand control head) capable of receiving VOR and ILS/LOC signals plus voice communications up to 126.9 mc. When coupled with a Narco 3A omni coupler, the company states, the Mark 10 provides a basic Comm/Nav package around which a full "2½ IFR system" can be built. Prices: $1,195 and $1,695, respectively.

Armsten Aviation Associates, Inc., North Little Rock (Ark.) Airport is marketing the Air-Comfort Stretcher, adaptable to most single and light twin-engine aircraft for ambulance purpose, although originally developed for a Mooney. Designed by an orthopedic surgeon, the aluminum stretcher and polyester mattress weighs 15 and a half



pounds; is six feet long and tapers from 18 inches at shoulders to 12 inches at foot. Engineered to withstand two to three Gs, the stretcher is secured by harness straps snapped to permanent cable affixed to right rear seat belt anchor bolts. Price f.o.b. Little Rock, $99. Dealer inquiries invited.



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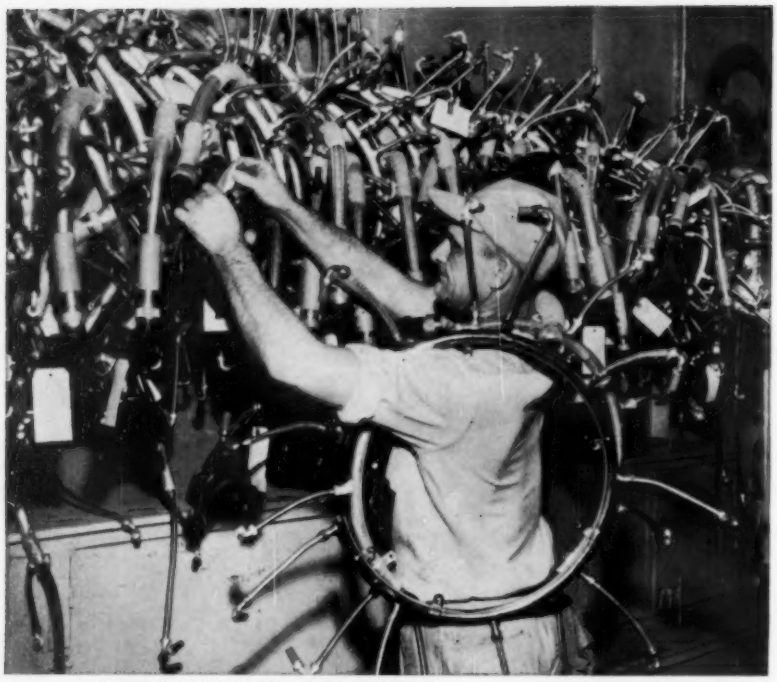

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WHO and WHERE

Dr. William Requarth, president of the National Pilots Assn. is new chairman of the General Aviation Council, succeeding H. B. Wetherell. Joseph T. Geuting Jr., manager Utility Council of AIA, was re-elected secretary-treasurer.

Joseph Roos is appointed chairman of the board of Air France, to fill vacancy left by Max Hymans, who retired for reasons of health. Upon retirement, Hymans was honored by the French government with promotion to Grand Officer of the French Legion of Honor.

L. E. Jordan, Scott Aviation's general sales manager, has assumed newly created position of corporate director of marketing, commercial, civil aviation and military divisions, Lancaster, Pa. Richard A. Noelck, former western manager, has taken new post of sales director, all divisions; Eugene J. Finn is director of contracts administration. Regis J. Stevenson remains sales manager of civil aviation products; and Kenneth L. Malick sales manager, military products. Robert J. Brewer former assistant sales manager, commercial sales, is now sales manager of that division.

Martin M. Decker, president of the Decker Corp., assumes newly created office of senior vice president, National Aeronautic Assn., to serve with Jacqueline Cochran, re-elected NAA president. Arlene Davis, Edward C. Sweeney and William P. McCracken Jr. were re-elected secretary, treasurer, and general counsel, respectively.

Richard L. Bean, public relations director of Lockheed's California Division in Burbank has been transferred to New York office in capacity of manager. Erik Nelson is appointed director of Lockheed's new regional office in Ottawa, Canada.

Alan S. Boyd, former member of the Civil Aeronautics Board has been named CAB chairman, replacing Whitney Gillilland. Robert Murphy replaced John Stewart Bragdon as a member of the board.

Maxwell W. Balfour, director and vice president of Spartan Aircraft, Tulsa, Okla., has retired from company management but will continue in the capacity of consultant. Byron E. Gardner has taken Balfour's place on Spartan's board.

Capt. Chuck Banfe, who recently piloted a Super-V on round-the-world record flight was named "Flyer of the Year" and presented with a National Achievement Trophy by the Touchdown Club of Akron, Ohio. Banfe shared honors at the club's dinner, January 21 last, with "Boxer of the Year" Floyd Patterson, and "Athlete of the Year," Rafer Johnson.

Marilyn Link has assumed the duties of executive secretary of the Link Foundation, with offices in Room 414, 80 E. 42nd St., New York City. Dr. Frank Sorenson is appointed chairman of the Technical Assistance Board and Dr. Wayne O. Reed, deputy commissioner, U. S. Office of Education, to the Technical Assistance Board.

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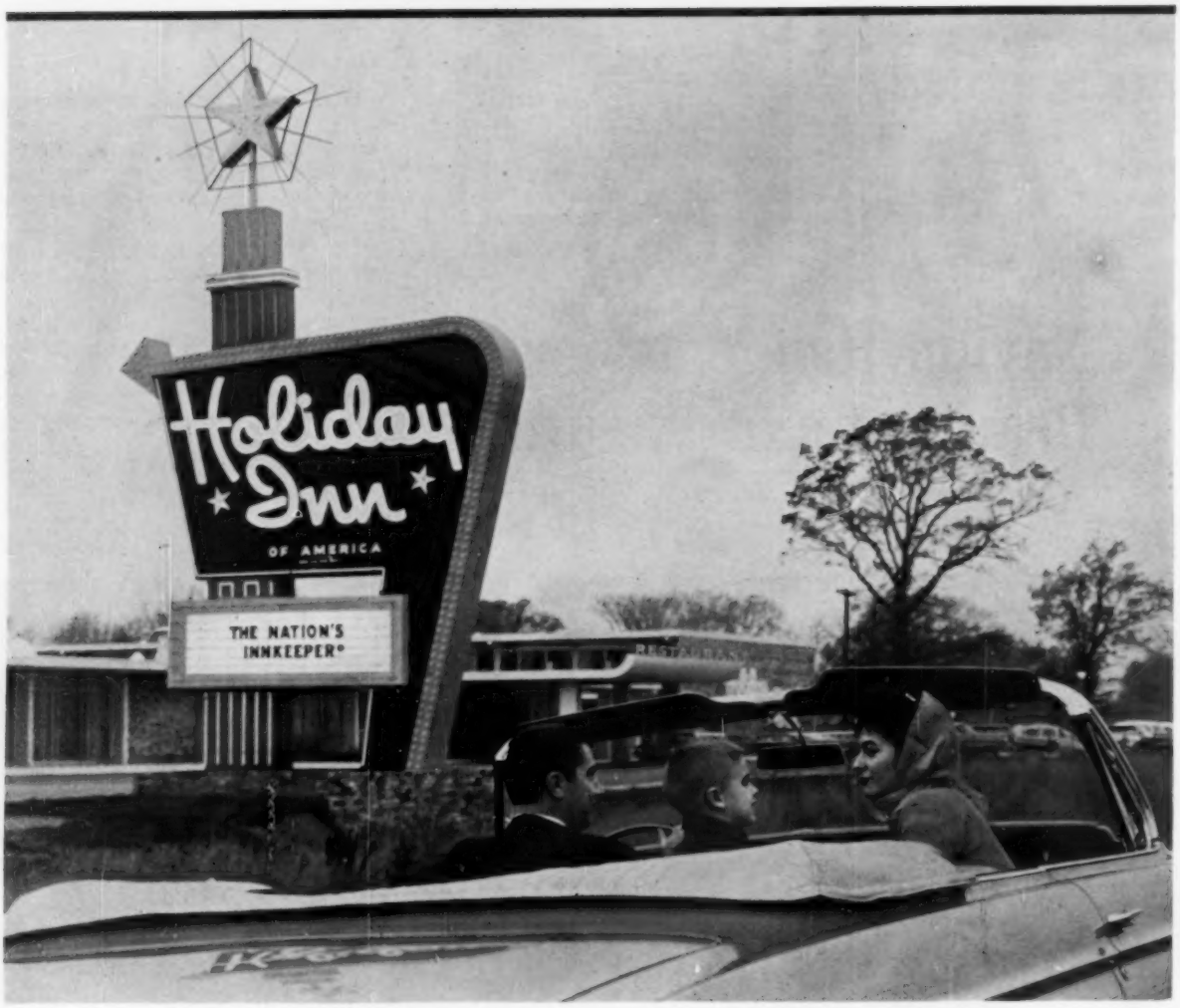

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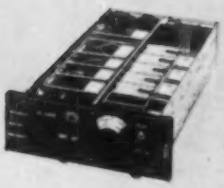

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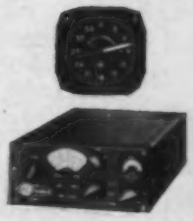

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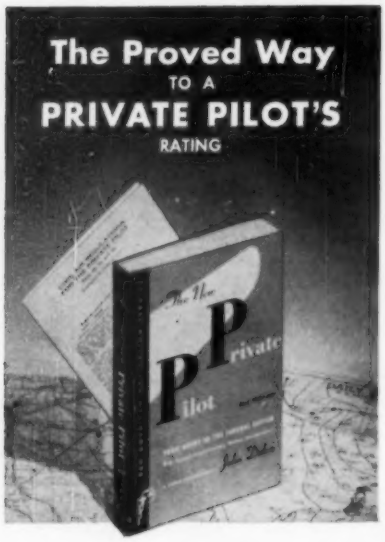

Best proof of the value of this new Zweng Manual is 4 printings in 16 months. It's a complete text — includes basic instrument flight, latest typical examinations, and answers, all necessary reference material including navigation and weather charts, plus a 32-page supplement of current Civil Air Regulations.

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HAVE YOU READ?

By JAMES F. SUNDERMAN

FATE IS THE HUNTER, by Ernest K. Gann (Simon & Schuster, 630 Fifth Ave., New York 20, N. Y., $6.00).

Author Gann is no stranger to aviation literature. Several of his books, among them "Blaze of Noon," and "The High and The Mighty," have been produced as successful motion pictures. "Fate Is The Hunter" is the story of pilots who fly transport aircraft, based on personal memoirs of Gann who has been a professional multi-engine pilot for many years. It is the story of pilots' battle against fate which lurks unseen on every flight, ready to strike, sometimes fatally, sometimes with last minute mercy, bringing terror and fright to the heart. Ever present, it soon becomes a part of their air discipline as a credo, "always be ahead of the aircraft." It is this battle with fate that makes these men the safest pilots in the world.

THE AEROPLANE: AN HISTORICAL SURVEY, by Charles H. Gibbs-Smith (His Majesty's Stationery Office, London, England, distributed by British Information Services, 45 Rockefeller Plaza, New York 20, N. Y., $6.53, postpaid).

In typical British historical detail this distinguished volume sweeps across the evolution and development of the airplane and aeronautics from Sir George Cayley to modern rocketry.

This exemplary deep dip into air history winds up with a table of early flights and attempts to fly, a chronology of aviation firsts and dates, glossary of air terms, bibliography and index. More than 140 photos and 40 line drawings provide illustration.

Critics have concluded it to be ". . . the finest survey of the aeroplane that has yet been compiled anywhere . . ." It is a must for all aviation collections.

THE SKY SUSPENDED, by Drew Middleton (Longmans, Green, 119 W. 40th St., New York 18, N. Y., $4.50).

It was Adolph Hitler's dream to bring Britain to her knees through aerial bombardment prior to ground invasion early in WW II. In the Summer-Fall of 1940, he directed the powerful Luftwaffe against the island stronghold. A handful of Royal Air Force pilots in the air, backed up by a nation of people willing to pay any price to survive, foiled his plan. The Battle of Britain is an epic that stands with the great human events of all times and is written here in detail and compelling portrait by a man who lived through it. Middleton was Chief London correspondent to the New York Times during this period and writes from first hand knowledge.

BLACK THURSDAY, by Martin Caidin (E. P. Dutton, 300 Park Ave. S., New York 10, N. Y., $4.95).

Schweinfurt is a name indelibly stamped in the minds of thousands of WW II airmen. For it was the massive air bombardment attack on this important Nazi ball bearing center which produced one of the greatest epics in the history of air war. On Thursday, October 14, 1943, combined formations of 291 B-17 Flying Fortresses, manned by more than 3,000 air crewmen, collected over the English Channel and headed for a deep penetration of the Continent to destroy this industrial complex, thought by many to be the Achilles' heel of the German war effort.

But German intelligence had learned of the pending attack and German air and ground defenses were waiting. Swarms of Nazi fighters hit the formations on the run to target, caught them again on the return flight. Ack-ack, positioned along the flight path, threw up a barrage of flak that airmen swear could be walked on. Sixty of the big aircraft went down in flames and 600 highly skilled airmen never returned.

Determined American crews bored ahead despite the uncompromising German resistance. To Hitler and the German people the mission had one ominous meaning. Nothing could stop an air attack and Schweinfurt was a prelude to the aerial destruction of the nation.

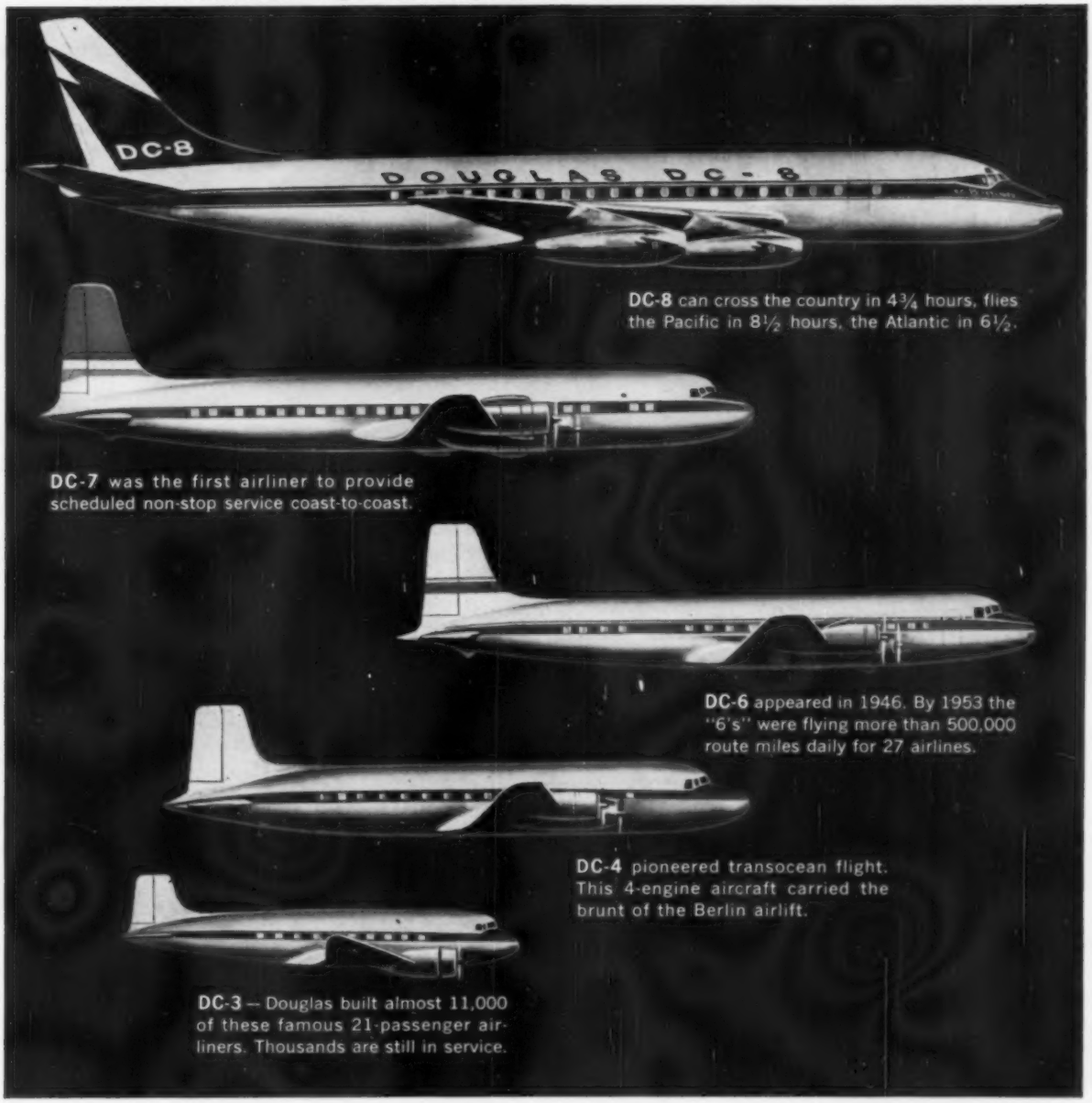
AMERICAN COMBAT PLANES, by Ray Wagner (Hanover House, 575 Madison Ave., New York 22, N. Y., $9.95).

More than four years of research is represented in this comprehensive reference history and statistical guide to all American combat type aircraft built since 1917 for the Army Air Force, the USAF, the Navy, Foreign governments, and including foreign aircraft procured for U. S. air units. This massive desk and library sourcebook contains hundreds of photos of each type and model fighter, bomber and reconnaissance plane that at one time or another has been a part of U. S. military air inventory.

A wrap-around design, production, combat historical narrative includes a wide assortment of detail such as armament, purpose and mission of aircraft. Tables of design and performance specifications of each aircraft featured adds value to this encyclopedia of U. S. military aviation.

If you have trouble securing books reviewed here, send payment in check or money order to AEROSPACE BOOK CLUB, 7801 Old Dominion Road, Washington 14, D. C. Your books will be sent postpaid.

One of a series of advertisements showing the breadth of Douglas experience being devoted to commercial, military and space-exploration projects.


DC-8
DOUGLAS DC-8
DC-8 can cross the country in 4¾ hours, flies the Pacific in 8½ hours, the Atlantic in 6½.
DC-7 was the first airliner to provide scheduled non-stop service coast-to-coast.
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Douglas, builder of the 5 great "DC" airliners that did so much to shrink the world you live in, is now at work on the great rockets and rocket ships which will shrink the solar system.

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Every plane bought for business today is, or should be, bought to do a specific job and fill a specific need. The day is gone when the glamor of aircraft ownership is an excuse for this major investment.

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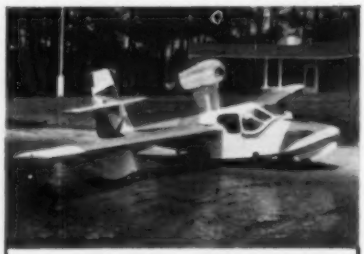

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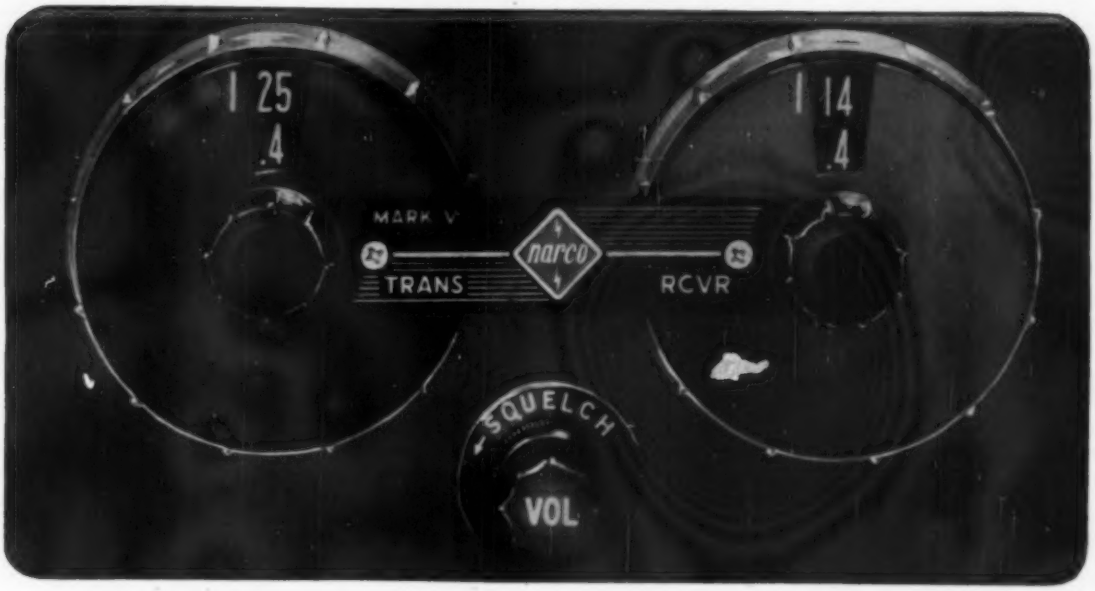

The Narco Mark V gives you 90 transmitting channels (118 – 126.9 mc), 190 crystal-controlled receiving channels (108 – 126.9 mc) covering *both* communications *and* navigation frequencies. Separate control heads permit completely flexible operation and use of the receiver section for VOR and ILS/LOC navigation with the Narco VOA-3A omni converter attached.

*Recently revised FAA "Frequency Deployment Plan" eliminates proposed requirement for TSO equipment for IFR and assures satisfactory IFR operation below 24,000' until at least 1966 for aircraft equipped with communications units having 100 kc spacing and frequencies below 127 mc.

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NATIONAL AERONAUTICAL CORP., FORT WASHINGTON, PA.

Jeeb's Job

GILL ROBB WILSON
Publisher

PROBABLY BY NOW N. E. "Jeeb" Halaby, new Administrator of the Federal Aviation Agency, has been assured he has the world's most impossible job and needs his head fixed for taking it.

I disagree. For the right man, the job of FAA Administrator is about the happiest assignment imaginable.

Of course it depends upon what one considers to be a good job. Admittedly the pay isn't too good, the problems are infinite, the co-operation is dubious, the pressures are manifold and there are only twenty-four hours in a day. If a man is looking for gelt, glory and glamour the FAA is a dust bowl. And I suppose it has become the vogue to think that anybody who looks for anything else has bats in his belfry.

But that's a viewpoint that has to be changed if this country is to be delivered from the cynics. So let's look at Jeeb's job from the sunny side of the street.

In the first place, as a top hand pilot of almost thirty years experience, including experimental test flying, Administrator Halaby assuredly knows that he is working with one of the country's greatest human resources—the American airman. The sum total of airman ability is a vital element of our national strength. It is akin to the human force that dug the east coast out of the wilderness, that pioneered the west, that flung our commerce around the world. Every man and boy and woman and girl who lifts off a runway is a part of it . . . a partner of the United States in defense of freedom, in expansion of commerce, in the pursuit of happiness and in preparation for mankind eventually to become migratory in the universe . . . for in such a role I view the air activity of our times.

No airman could be designated to increase this resource without feeling an overwhelming sense of responsibility, without wanting to cry out to every one in a cockpit everywhere, "help me; help me by improving your own standards; help me by greater co-operation among yourselves: help me by seeing that the whole of our human airman resource is greater than any of its parts."

Probably the cynics will deny that any cross section of citizenry will willingly make sacrifice to put the interest of the country above its own . . . to scorn the idea that the American airman could spearhead an about-face from the cancer of self interest that threatens the land.

But let me point out that the airman has a unique capacity for dedication by and large or he wouldn't be an airman. Those who cruise around enough to get a God's eye view of the world are apt to become pretty straight thinkers. One of the things they understand is that even with the millstone of Communism about their necks, the Soviet people have made great sacrifices, have demonstrated a great dedication to lift themselves, even in chains, to a better destiny for their children. If we can't match it, woe to us, regardless of the conflict of ideology.

But ability to rally this national resource of airmanship and even use it as a fulcrum for renewed dedication beyond the perimeters of the airman's world is only one of Halaby's challenges.

Another is to get at the root of our difficulties—economics, safety, technology, human engineering—rather than seek cures for conditions which have been created without warrant of necessity.

Maybe airlines should be flying formation to relieve the burden of traffic control. Maybe we should abolish the procedure of stacking. Maybe we should subsidize feeder service by chopper in certain areas. Maybe pilots in jet commerce should spend four hours a month on emergency procedures in a simulator. Maybe all flight instruction should start "under the hood." Maybe fixed base operators should be cleaned up, painted up and rated. Maybe we should find out why service, spare parts and maintenance costs drive so many aircraft owners out of flying.

I do not know the answers to these and a thousand other problems that come to mind but I know that curing an evil after it develops is much more costly than preventing it in the first place. If all the strawmen that have been set up to tilt against for selfish purposes were to be burned in one pile at one time much of the smog that has plagued aviation would disappear instanter.

Mark Twain once said that everybody complains about the weather but nobody does anything about it. That's another of Halaby's challenges. Something can be done about it. However I only refer to it as illustrative of innumerable other challenges to an FAA Administrator.

I'll not deny that Jeeb's job is a test of courage and vision. I'll not deny that he can't do it alone . . . that it's a part of every airman's job as well. I hope we got enough of the spleen out of our aggregate system in kicking Pete Quesada in the teeth to give another good man a better chance. Or do we want leadership that we can push around for our own ends?

If Jeeb's job isn't a good one, then we airmen should do some soul searching. After all, a leader can't lead if nobody follows.

THE NEW 707 ASTROJET* JET AGE: STAGE II

Now offered in regular transcontinental passenger service, American Airlines' new 707 Astrojet brings you a new standard of jet performance by the airline that's *first choice of experienced travelers.*

Powered by revolutionary new Jet-Fan engines, the 707 Astrojet greatly outperforms all other airliners. It takes off more quickly, uses far less runway than the best of standard jets. Aboard it, you experience a wonderful feeling of confidence as the Astrojet climbs swiftly to cruise easily, smoothly, within the transonic range—faster than any other jetliner in the world.

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AMERICAN AIRLINES
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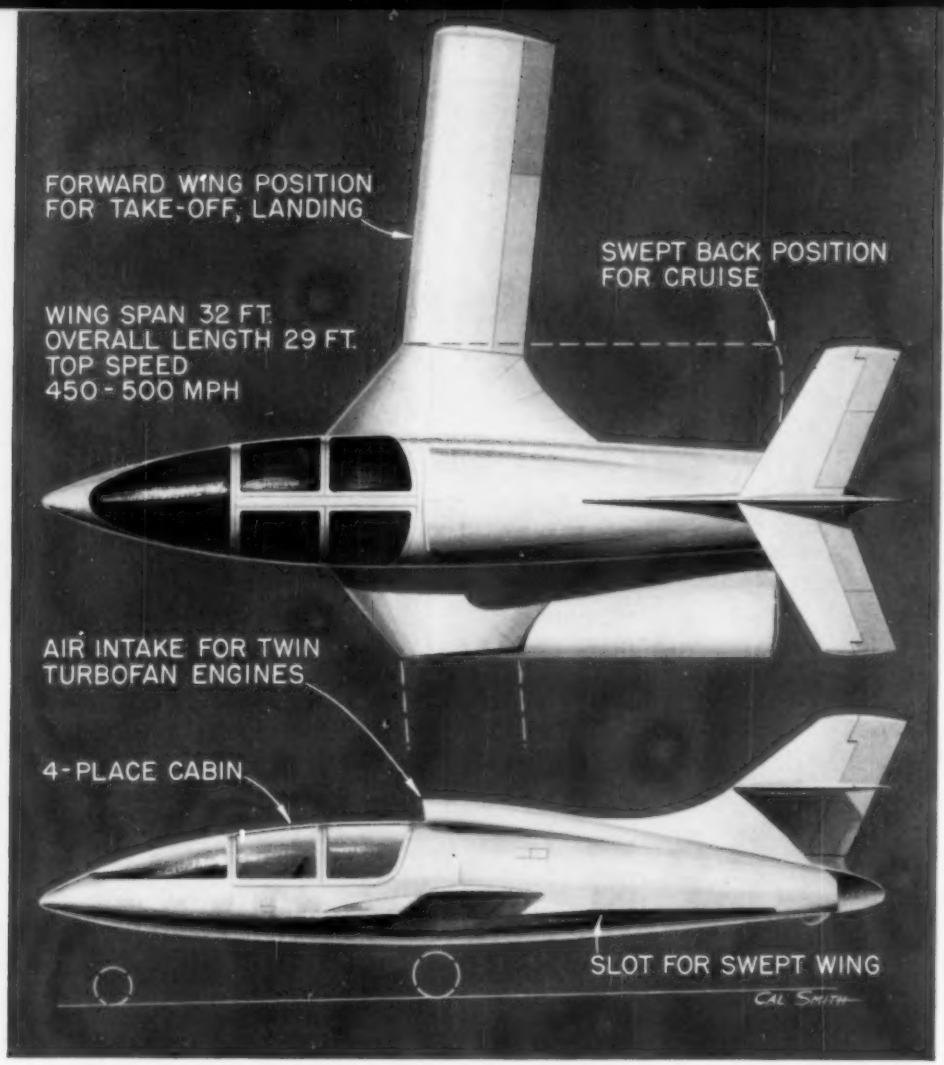


A new and simplified type of variable-sweep wing promises high cruising speed with low landing and takeoff speed.

Lightplanes OF THE Future

Radical new changes in structure, design and propulsion systems are being planned by most of today's manufacturers

By J. S. BUTZ JR.

IT SEEMS REALISTIC today to predict that the appearance and performance of lightplanes will change radically during the next five years in spite of the fact that such predictions have been wrong for the last two decades.

The new technology required to make major improvements in the structures, aerodynamic design and propulsion systems of light subsonic aircraft is available. Even more important, the business and economic situation in the lightplane manufacturing industry seems right for these changes.

Any discussion of big changes in lightplanes must begin with the business side of the problem. This is true of any modern industry. The industry's state of growth and the condition of its market are controlling factors.

By any measuring stick, lightplane manufacturing in the United States is big business today with more than $200 million total sales last year, and to all appearances there is a solid and growing market for these aircraft. The principal firms supplying this market have reached maturity in both the business and technical sense. Their formative years were the lean ones of the 1930s. They expanded unnaturally during the World War II boom, weathered the bursting of the lightplane bubble in the late 1940s and now enjoy a prosperity that was not generally anticipated 10 years ago. As a result of the recent prosperity and the growing market, most lightplane manufacturers command substantial financial resources.

A very close comparison may be drawn today between the lightplane and the automobile industries. Three firms have emerged as leaders in each field. There is intense competition between these firms to increase their percentage of the yearly sales. This competition can make the effect of any management mistake, such as adopting a new technical development prematurely, almost fatal business-wise through a large and sudden loss in sales. Therefore, even though the lightplane and auto manufacturers now have several major technical opportunities to improve their product, they must exercise extreme caution.

There are many problems connected with bringing a successful research development, such as a radically new and improved engine or structural material, into commercial use. Some of the problems are technical, but these usually can be handled by a competent analysis. The big uncertainty is judging the time at which the public is ready to accept a new development and the most effective sales campaign to use.

Certainly two of the best examples of misgauging a market in the past few years are in the medium price and compact car fields in the United States. A major U. S. auto builder invested over $50 million in bringing out a new medium-priced car which had to be abandoned in about two years. On the other side of the picture, the compact car caused an unexpected revolution of considerable proportions in the automobile business, and European firms reaped its early profits.

While the U. S. lightplane market has not been rocked by any revolutionary changes yet, there is the distinct possibility that this could occur in five years or so. Undoubtedly, most of the technical changes during this period will come in an evolutionary manner, with improvements appearing in new models on a yearly basis. In many ways evolutionary changes are desirable to both the manufacturer and the customer. Among the benefits are delayed obsolescence, high resale value and the possibility of establishing an enduring line of aircraft built around a given set of basic concepts but of growing excellence and public reputation.

Balanced against the advantages of evolutionary change is the chance of being first with a major new technical development and scoring a compact car type

Army STOL research aircraft, the Fiberglass Marvel, uses boundary layer control system, turboprop, propeller shroud.

of success which is certain to intrigue every aircraft manufacturer.

Regardless of what type of changes are planned for their aircraft line, most manufacturers maintain complete silence about them as long as possible. A good example is Cessna's new light-light, twin-engine airplane, with engines mounted on both ends of the fuselage in a push-pull arrangement. This aircraft has been in design for some time and is scheduled to be ready for sale in 1962, but its existence was not announced until last fall, a few months before its first flight.

This new Cessna, named the Skymaster, has an unconventional configuration for the U. S. lightplane market and is designed primarily to ease the engine-out piloting problem for the twin-engine airplane. However, many innovations of a more basic nature are now possible in lightplane design, and they are being studied by all manufacturers. There are four systems and ideas which currently appear to have the most potential to bring about major changes in the performance and configuration of light aircraft. These are:

- Turbine engines
- Plastic construction materials for stress bearing structure
- Boundary layer control
- Variable sweep wings

The first three of these items have extensive development histories, and at one time or another great predictions have been made about the marvelous and immediate benefits they were going to bring to private aviation. Even though these predictions did not materialize on the proper schedule, there are a number of reasons why it seems correct to expect them to be realized during the next few years.

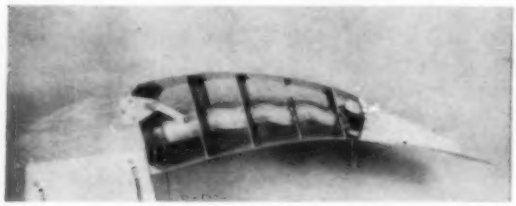
Regarding turbine powerplants, there is really only one reason why they are not in wide use in light aircraft today, and that is high cost. Reciprocating engines are still much cheaper to purchase and in some cases cheaper to maintain and to operate, and they have an enviable record of dependable performance. These are difficult advantages to top in unseating the principal type of powerplant in any class of flight vehicle.

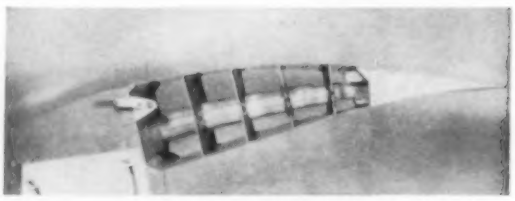
In the next few years, the cost of turbine engines is almost certain to come down while their efficiency continues to rise because of the large amount of money and effort being expended in these directions. While aviation companies pioneered these powerplants and still are investing large sums in their development, the potential advantages of gas turbines have attracted other industries.

Some of the most important research aimed at low cost gas turbines has been conducted by auto firms. The goal of this research is a cheaper engine than those in present cars and one which uses less gasoline. There is evidence that this goal has been reached and that only the tremendous implications of a complete retooling in the automobile engine business and the uncertainties of public acceptance are keeping these engines from being marketed.

At any rate, the research experience of the auto firms has had and will have a continuous influence on the effort to build inexpensive, rugged, relatively low-temperature gas turbine engines for flight use.

Another development which is beginning to add pressure for the use of gas turbines is the increased appreciation for the advantages of turbofan engines. Engine companies are studying almost every conceivable type of turbofan, ranging all the way from turboprops with shrouds around them to the relatively small-diameter





Right: Fiberglass construction permits the whole wing to be bent smoothly into a curved airfoil for a change in camber, eliminating sharp contour break of flaps. *Below:* Prototype Marvelette under construction will test the new wings.

Cessna's new light-light twin is now undergoing flight testing and shortly will be introduced to the market. A major innovation is mounting of engines in push-pull arrangement to eliminate the problem of engine-out torque. Named the Skymaster, it seats four, has specially designed Continental engines.

turbofan engines of the type that is now going into airline service.

One of the main design variables for these families of possible turbofans is the bypass ratio, which is equal to the weight of air passing through the fan divided by the weight of air passing through the gas turbine. Turboprops have very large bypass ratios, and the turbofans in current use have low bypass ratios. A high bypass ratio means that the diameter and static thrust of an engine will be high and its maximum efficiency will be realized at a relatively low cruise speed. A low bypass ratio means a small engine diameter, relatively low static thrust and a high cruise speed to develop maximum efficiency.

It is possible to design a turbofan with a diameter anywhere in between that of the turboprop and the turbojet and to achieve an exceedingly wide variation in the bypass ratio and performance. This gives the aircraft and engine designers a very powerful tool which enables them to match a turbofan efficiently to aircraft in any subsonic speed class. High thrust can be generated for short takeoffs and good propulsive efficiency and low fuel consumption can be provided from 250 mph on up. This design latitude effectively overcomes two of the former drawbacks of turbojet engines—low static thrust and poor fuel consumption when cruising below 500 mph or so.

The feasibility of using reinforced plastics as primary stress-bearing structure was proven conclusively shortly after World War II through military test programs. In one of the most conclusive tests, run for the Air Force by Eastern Aircraft Co., wings made completely of glass fiber were static-tested and flown on a T-6. They proved to be lighter and stronger than the original wings. Equally important, the smooth surface of the wings lowered the drag and raised the top speed of the test T-6 by a significant amount. This quality will greatly reduce the skin friction drag of any aircraft made entirely of fiberglass.

Reinforced plastics technology has improved continuously in the last 10 years. Glass fiber is in wide use on small pleasure boats and some ocean going types as primary hull structure. Several European sailplanes are made entirely of fiberglass. The auto companies have experimented with it exhaustively, including tests on frame and body units integrated into one stressed skin structure resembling aircraft practice. One successful U. S. sports car in rather large scale production has had a fiberglass body for several years. True mass production of fiberglass automobiles seems to be waiting for a favorable prediction of public acceptance and a slightly better economic position relative to sheet steel.

The question of public acceptance and saleability also seems to be the main stumbling block to the use of fiberglass for all lightplane structure except the engine mount. Among its advantages for (*Continued on page* 78)

New York Airways prototype on route checks from the new lower Manhattan heliport. Production models of 25-passenger 107 cruise at 155 mph.

This fast-stepping new tandem-rotor helicopter opens new vistas in inter-urban and city-to-airport transportation

TWIN-TURBINE VERTOL

Left: Removable panels allow easy access to electronics equipment and turbines. *Below:* The water-tight fuselage is sealed during fabrication.

By A. C. BASS

PILOT REPORT

107

TIME, 32 minutes; route, downtown Philadelphia to downtown Manhattan; equipment, Boeing-Vertol 107. This heliport-to-heliport flight by the twin turbine Vertol prototype represents a fast, safe answer to one of air transports growing needs. An answer that eliminates the minutes and hours consumed in ground travel to and from the outlying airports—time that often more than equals the flight time over short haul, city to city routings.

When New York Airways accepts delivery of its first 25-passenger V107 II this summer, a giant stride will have been taken in the natural progression of airline travel—if the CAB extends NYA's routes between the two cities.

To better ascertain the potential of the V107, FLYING took a long hard look at this fast tandem-rotor aircraft (production model guaranteed cruise is 135 knots or 155 mph) with its responsive fixed wing control characteristics, and evaluated it in every phase of flight.

The Vertol 107 II is the derivative of a program started in 1956. After 18 months of research and development and more than two years of actual flight test by the U. S. Army, the 107 is ready as a commercial liner and is expecting FAA certification within the next few months.

Powered by twin General Electric T58-110-1 (T58-8) engines rated at 1,250 shaft horse power (SHP) each at takeoff settings, the production 107 II can carry a useful load of over three and one-half tons and exceed the FAA requirements for a category A helicopter (which call for a minimum en route rate of climb of 100 fpm with one engine out).

The engines are mounted side by side in stainless steel compartments in the aft pylon at a level just above the fuselage crown and behind the cabin to cut the noise level and add to passenger comfort. The price of each engine is $70,000.

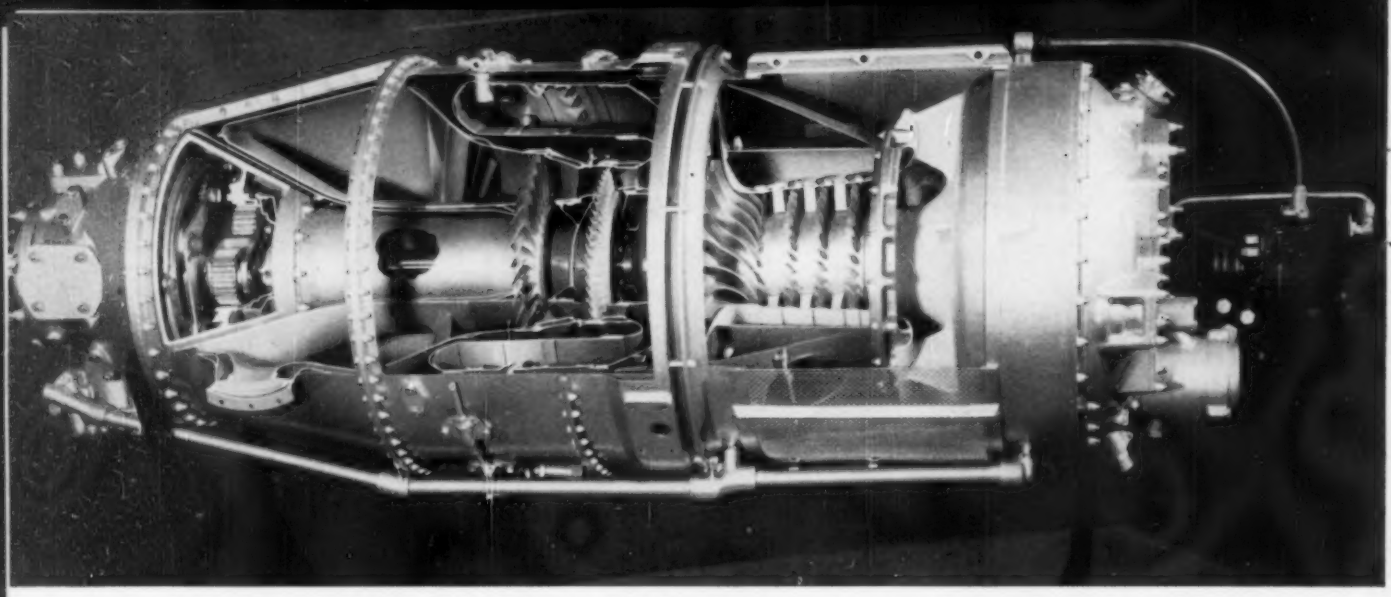
The prototype 107 flown for the evaluation employed the small Lycoming YT-53 770 SHP engines which limited the aircraft's speed and performance to well below that which the T58-8s will afford.

The Vertol Division of Boeing Airplane Company in Morton, Pa., has firm orders for five 107's from New York Airways with an option for an additional five. Options have also been placed on 10 to 15 of the rotocraft in the European market.

The basic price of the V-107 in its airline configuration is $507,280, not including engines or radio and navigation equipment.

The 107 is boarded by self-contained stairs located directly behind the cockpit bulkhead on the right side of the aircraft. The roomy flight deck area located in nose of the 107 is entered via the cabin and offers a maximum of visibility over the clean instrument panel and around and under either side of the center console. The console houses the navigation and radio equipment, and the engine controls.

For starting, the engine programing lever for the number one, or left, engine, is placed and held in the proper start position by an inner lock which operates with the rotor brake on. The starter is then depressed for the light-off and the automatic fuel flow regulates the amount of fuel to give an engine rpm of 11,000 and a tail pipe temperature (TPT) (*Continued on page 82*)



Only 19 inches in diameter, 61.5 inches long, the Canadian Pratt & Whitney PT6 is designed for easy maintenance, high power-to-weight ratio.

CANADA'S SMALL GAS TURBINE

the PT6

Soon to fly, the light turboprop/turboshaft is designed for both fixed- and rotary-wing aircraft

By ROBERT I. STANFIELD

SMALL TURBINES are picking up steam necessary to their penetration of the light aircraft market. A prime example is Canada's first turboprop/turboshaft—the small, rugged, 500-eshp PT6—soon expected to fly in testbed configuration both with a seven-place light twin and a five-place helicopter.

The lightweight free-turbine PT6, developed by Canadian Pratt & Whitney Aircraft, a United Aircraft Corp. subsidiary, will be produced in two versions: the PT6A-3 turboprop, whose dry weight will not exceed 250 pounds, and the PT6B-3 turboshaft, which will weigh not more than 225 pounds.

The turboprop, aimed at light to medium single and multi-engine aircraft, including VTOL, should begin flights next month, fixed to the nose of a bailed Royal Canadian Air Force Beech model 18. The turboshaft, running slightly ahead of the turboprop, is under study by most major helicopter manufacturers; Hiller, for instance, has a mockup at its facilities, fitted to an E4 in five-place configuration, which will be followed up by actual "hardware" so that the rotorcraft can be tested.

Pratt & Whitney studies of a typical twin-engine pressurized aircraft performance at respective maximum range and altitude for both piston-powered and PT6 versions show that the little turbine would have a better than 15 per cent advantage in speed and range. At maximum range power the velocity increment becomes 44 per cent in favor of the PT6 for the same range.

Pressurized aircraft will allow comfortable and economical cruise below 15,000 feet and, when necessary, climb over weather to 25,000 feet. The PT6, which may cost in the neighborhood of $15,000, eventually will be fitted to the Beech Queen Air for testing. During this editor's visit to Canada, one engine was with the National Research Council in Ottawa, running icing trials (ice ingestion and cold weather operation; an alcohol-spray arrangement for anti-icing is planned).

With a power-weight ratio of two to one, the small engine is adaptable for marine uses, with hydrofoils, in addition to its utility as an auxiliary power unit for large

aircraft. It will be qualified for JP-4, JP-5, diesel fuel and standard military automotive grade fuels.

Canadian Pratt & Whitney, at this writing, had eight engines running at its Longueuil (a suburb of Montreal) facilities. By April the PT6 will have had about 800 hours of full-scale running and about 4,500 hours of component development time (combustion systems, intakes, bearings, etc.). Flying test work will be accomplished at St. Johns, Que.

The small engine will pass its 50-hour preliminary flight rating test (PFRT) this year—possibly by summer. It will be available to the airframe people—for helicopter and fixed-wing certification programs—after its PFRT. Certification will come with the 150-hour production-type qualifications, usually about a year after the PFRT. And at this time—say at least by early 1963—the engine will be available to operators.

The military version of the PT6—designated the T74-P-2—is under consideration by the Army in its light observation helicopter powerplant competition. For this competition Pratt & Whitney derated the engine to 400 shp providing adequate power "at 6,000 feet and 95 degrees F—giving 290 hp at normal rated"—Army requirements. Sea level military rating is 350 shp on a 100-degree F day.

Above: As one of the turbines Hiller is studying, a PT6 mockup lends itself well to installation in this five-place version of the E-4. *Below:* When it flies in its bailed RCAF Beechcraft 18 testbed, the 250-lb. engine will turn a 100-lb. Hamilton-Standard three-bladed propeller.

Two endurance runs, both to a military type preliminary type rating test, have been completed by the prototype YT74-T-2: the first was simply an endurance run; the second was at power consistent with T74 model specifications. Dry weight of the T74 is but 200 pounds.

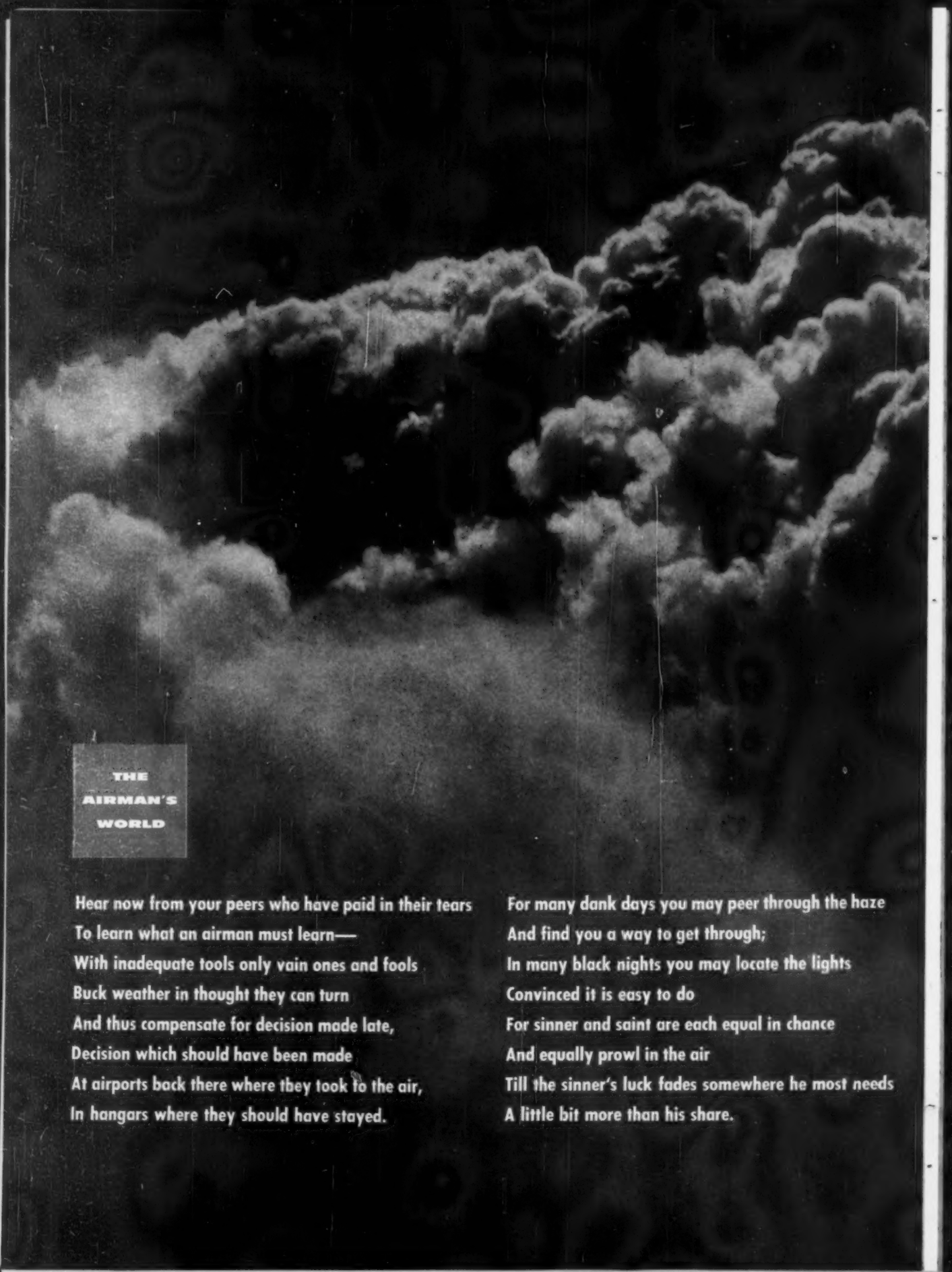
What are the advantages of this engine? Turbines generally, of course, are aimed at ease of maintenance, over-the-weather operation, high power-to-weight ratio, speed and economy.

Specifically, the PT6 turboprop, the testbed of which will turn a 100-pound three-bladed Hartzell propeller, is but 19 inches in diameter and 61.5 inches long. Guaranteed maximum fuel consumption at takeoff (500 eshp) is 0.69 lb/eshp/hr. The turboshaft at takeoff (500 shp) consumes no more than 0.70 lb/shp/hr.; while the diameter is identical to that of the turboprop, length is but 58 inches.

Design, on which studies began in October, 1958, permits continuous engine operation with the thrust axis inclined from 45 degrees nose down to 110 degrees nose up. Additional advantages of this engine, with its time-between-overhaul period aimed at 1,000 hours, include an integral oil tank providing a self-contained lubricating system for engine and propeller (eliminating airframe connections) and a low over-all engine noise level.

Axial compressor blades of the PT6 are identical, except for length. Stator blades are similarly standardized. Some of the reasoning behind Pratt & Whitney's decision to produce a free power turbine follows:

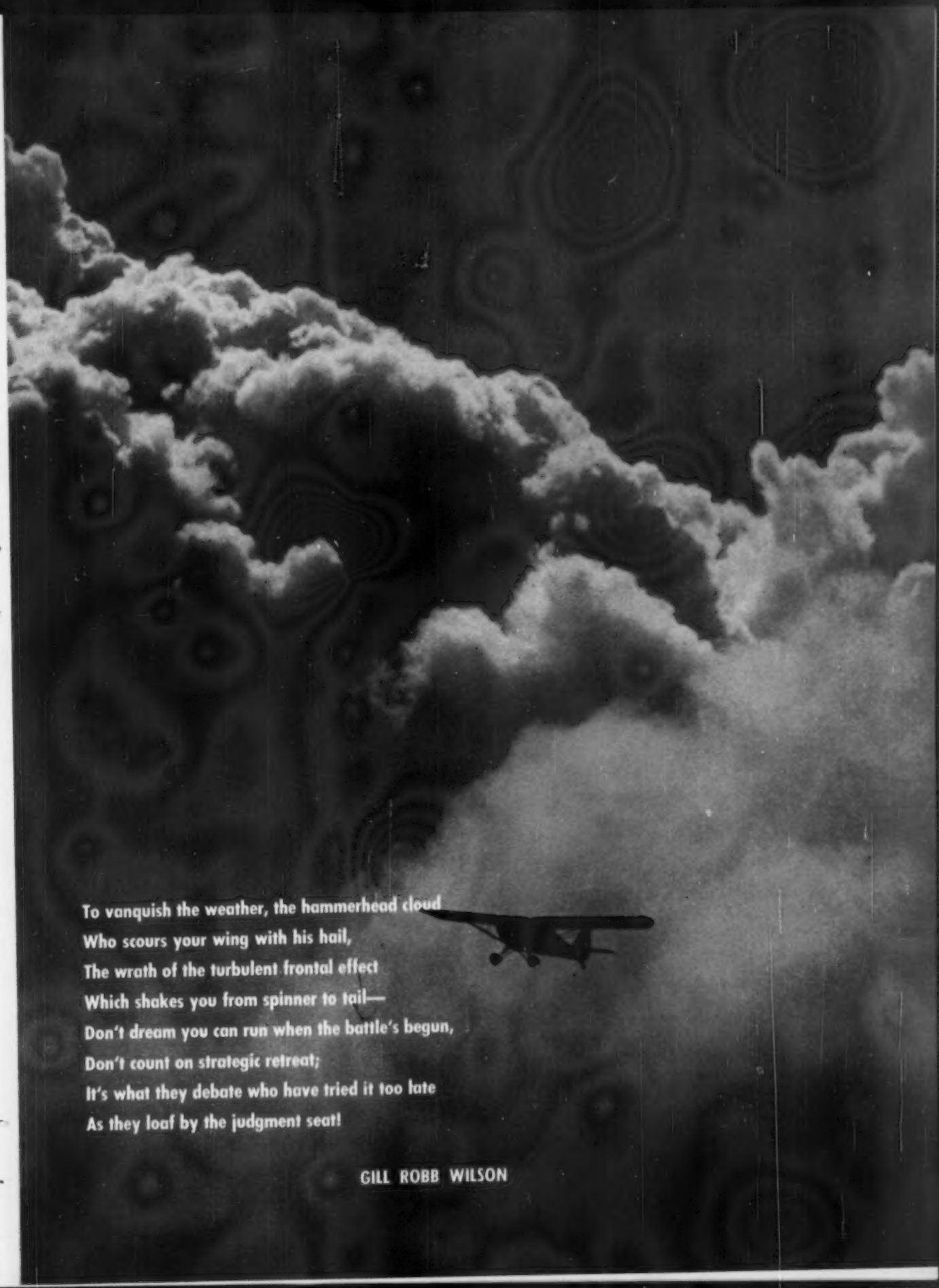
- Fuel control on the engine (*Continued on page* 88)



THE AIRMAN'S WORLD

Hear now from your peers who have paid in their tears
To learn what an airman must learn—
With inadequate tools only vain ones and fools
Buck weather in thought they can turn
And thus compensate for decision made late,
Decision which should have been made
At airports back there where they took to the air,
In hangars where they should have stayed.

For many dank days you may peer through the haze
And find you a way to get through;
In many black nights you may locate the lights
Convinced it is easy to do
For sinner and saint are each equal in chance
And equally prowl in the air
Till the sinner's luck fades somewhere he most needs
A little bit more than his share.



To vanquish the weather, the hammerhead cloud
Who scours your wing with his hail,
The wrath of the turbulent frontal effect
Which shakes you from spinner to tail—
Don't dream you can run when the battle's begun,
Don't count on strategic retreat;
It's what they debate who have tried it too late
As they loaf by the judgment seat!

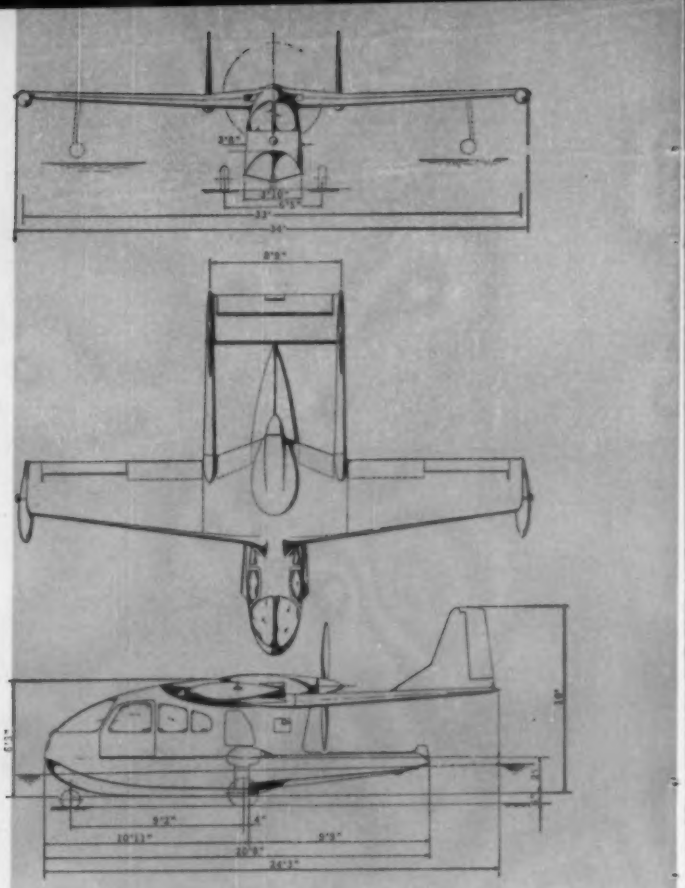
GILL ROBB WILSON

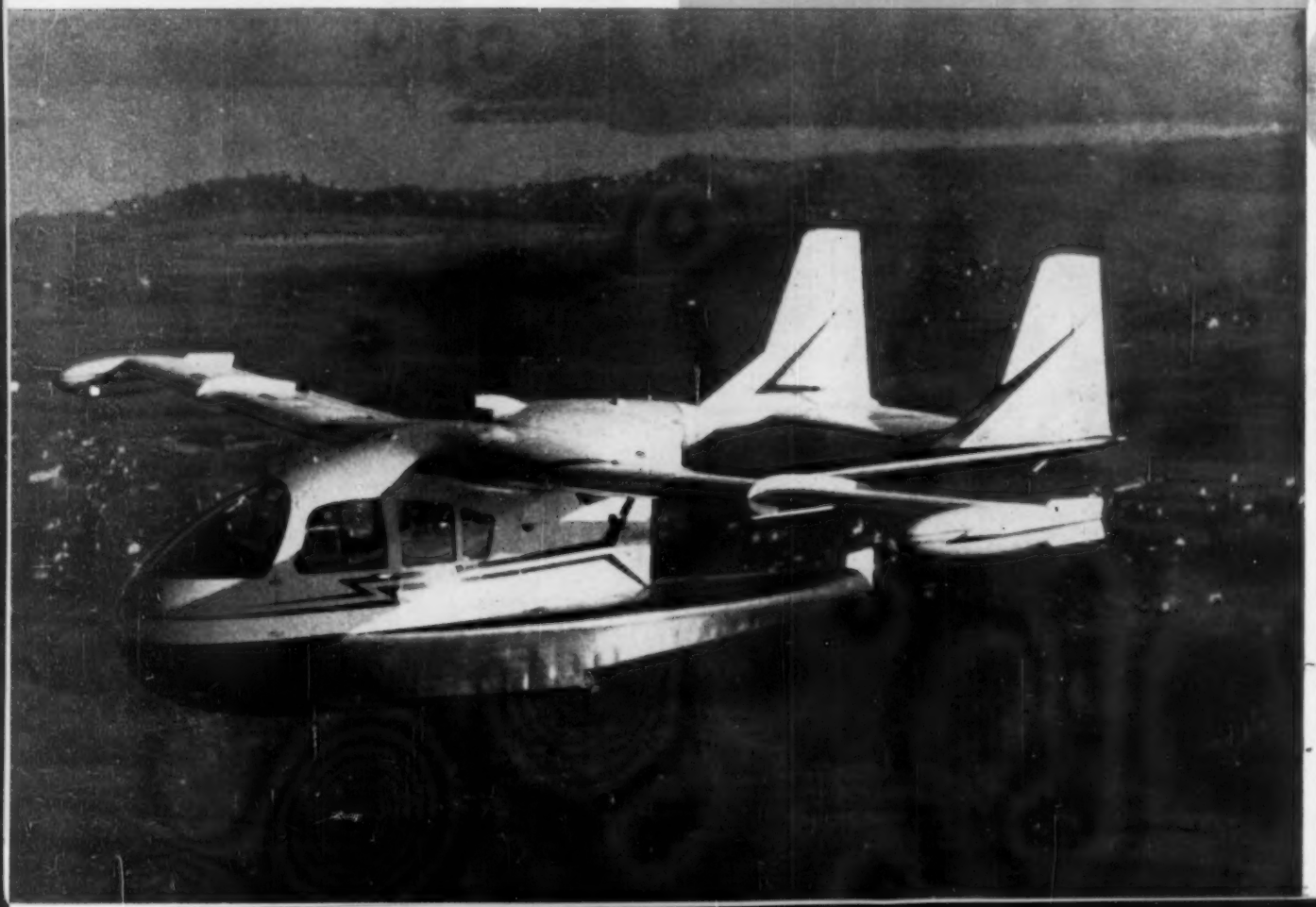
PILOT REPORT

Performance and engineering details of the new, single-engine Italian import, about to be marketed here in the States

By VICO ROSASPINA

RIVIERA AMPHIBIAN





SOON to be marketed in this country by Lane Aircraft Co., Dallas, Tex., the Italian single-engine amphibian, SIAI Marchetti Riviera, is a sturdy four-place, all metal aircraft with exceptionally good performance. The airplane, subject of this evaluation for FLYING, was flown by the author at the SIAI Marchetti facility at Vergiate, Italy prior to its shipment to the United States.

The rather unusual configuration of the amphibian was dictated by the desire to obtain best efficiency both as a landplane and a seaplane. The high placement of the pusher engine and the boom-supported empennage permits the propeller and the tail surfaces to be kept out of the water spray during takeoffs and landings. The retractable wing floats, which fold against the wing tips when not in use, serve a dual aerodynamic purpose of reducing drag and acting as tip plates, thus increasing the aircraft's efficiency.

Power is provided by a Continental I0470 fuel injection engine of 260 hp at 2,600 rpm for takeoff. The propeller is a Hartzell constant speed, reversible pitch. The entire structure of the Riviera is corrosion proofed according to U. S. Navy specifications. Common steels are used only where it is absolutely necessary. All structural members which come into contact with water are fabricated of either alluminum, stainless steel or nickel alloy. Care has been taken that dissimilar metals do not come into contact with each other, to prevent corrosion through electrolytic process.

For the evaluation, the Riviera was flown with 30 gallons of fuel and 3.5 gallons of oil. Standard fuel capacity is 37 gallons contained in two rubber cells located in the center section of the wings. Two auxiliary tanks of 14 gallons each can be installed in the outer wing panels, giving a total capacity of 65 gallons. With three people on board—myself, the copilot and a passenger—the total weight of the aircraft was approximately 2,820 pounds. Maximum permissible gross weight is 3,720 pounds.

Above: After a 1,500-foot run the Riviera is airborne from a lake. Aircraft was originally designed by Fiat-Nardi and still bears designation FN-333. The SIAI-Marchetti firm then acquired license to build the amphibian in 1959.

Left, above: Three-view of the Riviera to be marketed by Lane Aircraft Co. *Below:* Riviera in flight shows its clean lines. Note aerodynamic fences on wings which retard progression of stall from wing roots to the tips, making ailerons effective when inboard sections stall.

Access to the cabin is through two large doors on each side of the forward hull section, and entering the cabin is as easy as getting into an automobile, even for the ladies with narrow skirts. The cabin is roomy, and its eight windows offer excellent visibility and plenty of light. The seats are bench type equipped with foam rubber cushions. The forward one is adjustable fore and aft with both backs folding forward to permit entrance to the passenger compartment. There is space for luggage under the rear seat as well as generous room behind. Total baggage capacity is 330 pounds.

The airplane was equipped with dual controls and standard instruments consisting of airspeed indicator, sensitive altimeter, rate of climb, turn and bank, clock, magnetic compass and outside temperature gauge, all located on the left side of the panel. Grouped on the right side were the engine instruments: tachometer, manifold pressure gauge and fuel pressure indicator.

The stall warning indicator also is placed on the same side. On a small panel below are two fuel quantity indicators, one for each tank; oil pressure gauge; cylinder temperature indicator; hydraulic pressure gauge and the ammeter. Radio equipment consisted of a 36-channel VHF unit.

Throttle control, with vernier adjustment, propeller pitch control, mixture control and the elevator trim wheel with continuous position indicator are in the center of the panel.

Flaps, landing gear, wing floats and the water rudder, located in the stern of the hull, are hydraulically operated. Three selector controls, for gear, flaps and tip floats are located on the center pedestal. The water rudder is operated by a button on the control wheel. Position of landing gear and floats is indicated by six warning lights on the instrument panel.

Two top lights, red and green, indicate gear up or down; two lower ones show wing float position, while two lights on the side bear the words WATER (on the red one) and FIELD (on the green one) to indicate whether the aircraft is in seaplane or landplane configuration. Thus when the gear is retracted and the floats are down, the red indicator with the word WATER lights up. Conversely, the green FIELD light indicates landing gear down and floats retracted. A manual emergency hydraulic system, operated by hand pump, is provided in the event of main system failure.

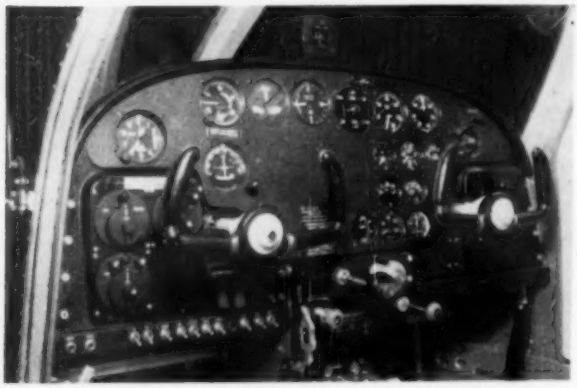
Flap position is shown by a dial indicator located on the console, just below the throttle.

The electrical system consists of a 24-volt d.c., 25-amp. generator with dual voltage current regulator and a 24-volt, 20-amp.-hr. battery located in the bow. The battery is easily accessible by unfastening the quick-disconnect landing light panel. Fuel pump and fuel booster pump are electrically driven. Circuit breakers are located in a small receptacle on the right side of the instrument panel. Cabin heating and windshield de-

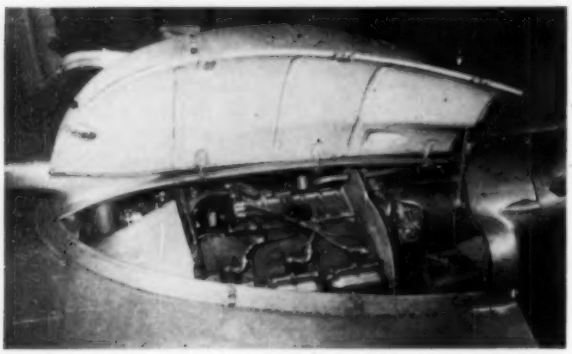
frosting is provided by two heat exchangers placed on engine exhaust pipes. Hot air is drawn from the exchangers into a mixing box to which cold air is admitted from two air scoops in the leading edge of the wing center section. Ducts from the mixing box vent air to the cabin and the windshield. A three-position push-pull knob permits regulation of the system to the desired temperature. In addition, the windows in the doors are designed so that they can be opened.

The schedule called for flights from both land and water in order to properly evaluate the entire performance range of the aircraft. As the Riviera was based at the Vergiate airport, the initial takeoff was from land.

After going through the check list procedure, the Continental engine was started and warmed up. It was easy to hold the airplane against the thrust of the propeller with the effective parking brake even when revving up to full power. As soon as all the engine instruments were in the "green," the aircraft was taxied out to the active runway using the grass strip on the side to test the shock absorbing qualities of the landing gear.



Above: Flight instruments and radio are grouped on the left, engine instruments on the right. *Below:* Engine is a Continental I0470-H 260 hp.



Visibility out of the windshield is excellent both forward and to the sides due to the generous glass area and because the nose is not encumbered by a cowled engine. It is almost like sitting on the glass-enclosed veranda.

Changing direction while taxiing is no problem; ground maneuverability is very good and the nose wheel steers easily with the rudder pedals. The Nardi shock absorbers give a smooth, comfortable ride, even on rough terrain, and are capable of absorbing ground loads at taxiing speeds as high as 50 mph.

Takeoff was made with 20 degrees of flap, requiring a ground run of 900 feet. The Riviera became airborne at an indicated airspeed of 75 mph (1.3 of stalling speed). At this speed, the airplane held its course well and was easily controllable in all three axes. At 105-110 mph IAS (20 degrees C outside temperature) the aircraft climbed at better than 1,200 fpm with gear and flaps retracted.

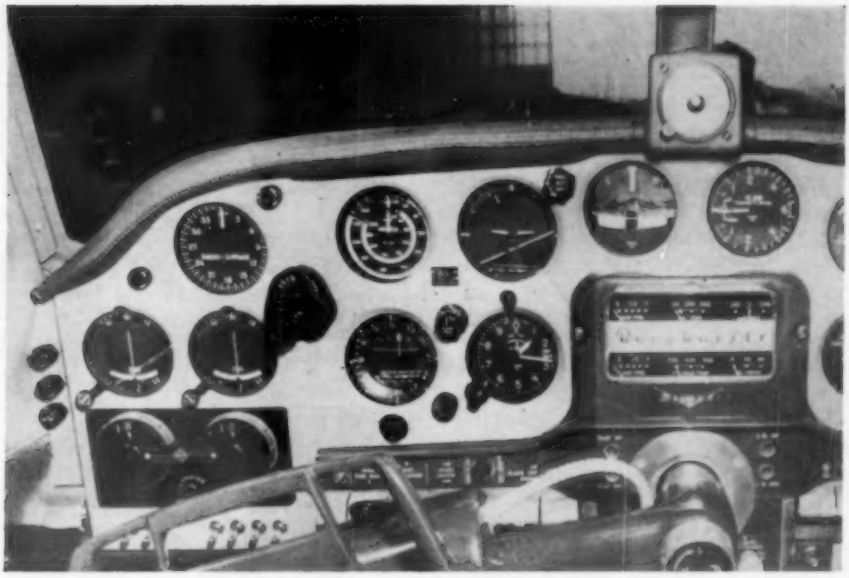
Leveling out at 3,500 feet, we proceeded with speed and stability tests. At 65 per cent power (2,250 rpm and 22 inches mp) the indicated airspeed was 150 mph; at 75 per cent power (2,400 rpm and 24 inches mp) the IAS was 155 mph. Static stability tested, in cruising configuration, from a minimum IAS of 95 mph to a maximum of 170 mph, with C.G. location at 29 per cent, showed the airplane to be statistically stable. Return to original trim position was accomplished with minimum oscillation. The airplane also proved to be dynamically stable as it took only four oscillations and 58 seconds to return to trimmed attitude (65 per cent power) after having been put through an oscillation phase with speeds varying between 105 mph and 190 mph IAS.

Encouraged by these good stability characteristics, we climbed the Riviera to 5,000 feet, where the airplane was put through normal and accelerated stalls in various configurations: with power off and on, landing gear, flaps and wing floats retracted and extended. Stalling speed varied from a minimum of 65 to 70 mph with power on, flaps and undercarriage extended, to 85 mph maximum in accelerated turns and side slips. The stalls, in most cases, terminated in clean downward pitch; tendency of a wing to drop developed only during stalls executed in turns or with power on. Even then, they were easily controlled.

At the end of these tests we proceeded to Lake Como to shoot water landings. Making sure that the landing gear was retracted and the wing floats down, a long approach to the lake was made at over 90 mph without flaps, but as soon as the flaps were extended we were obliged to slow down to around 80 mph in order not to come in short with excessive speed. After touchdown, control remained effective, and taxiing turns below 30 mph could be made without the use of water rudder. The water rudder is exceptionally useful on a windy day as precise water maneuvers can be made with it. The lake was calm that day, but the Riviera has been landed in a 15-knot cross wind on waves 2.5 feet high.

Here in Como, our passenger debarked and the two of us took off for the SIAI Marchetti airport at Vergiate. With 20 gallons of fuel remaining, and 20 degrees of flap, the Riviera got on the step, with slight forward control pressure, after a run of 1,000 feet. In another 500 feet it was ready to fly and a slight back pressure got it off the water at 80 mph IAS. A quick climb brought us to 4,000 feet in three minutes, following which we proceeded to the home base at cruising speed. The wing floats were retracted immediately after takeoff.

Approaching Vergiate airport, the landing gear was extended at 100 mph and the aircraft was landed with 45 degrees of flap. Ground-landing characteristics of the Riviera are completely conventional and similar to such single-engine U.S. aircraft as (*Continued on page* 58)



Altitude selector is at top left of directional gyro, which has rotating azimuth ring for automatic headings.

Solo IFR flying is a much less formidable task with the aid of the

MITCHELL AUTOMATIC PILOT

By RICHARD B. WEEGHMAN

AUTOMATIC TURNS to a preselected heading and climbs and descents to an altitude are major features of a lightweight Mitchell autopilot that combines high sensitivity with a kid glove touch.

The Mitchell automatic pilot has electric servo muscles that work right off the control yoke and a transistorized nervous system with quick reflexes in turbulent air and an aversion to steep dives or sharp climbs approaching a stall. The whole unit, not counting directional and attitude gyros, weighs 8.2 pounds.

Designed for single-engine and light twin business aircraft and labeled the Commander, it is one of six autopilot systems offered by Mitchell Industries, Inc., Mineral Wells, Tex. It was evaluated by Flying from Flushing Airport, New York, in Piper Comanche N5165 with George A. M. Denhofer, Mitchell's eastern service engineer.

Control console with servo engage knobs, master switch and trim light.

Each system uses standard units, permitting conversion from one to another. They range from the Co-pilot, with only heading lock and roll control, to the completely automatic, two-axis Commander.

Mitchell had several basis design aims for their autopilot: "They wanted something that offered speed and ease of installation, light weight and low current drain," said Denhofer. Installation time varies from eight to 16 hours, he said, depending on the amount of radio gear and other equipment in the way.

Installation cost varies, therefore, from about $100 to $175, he said. A 25- to 45-minute flight is required to adjust all of the automatic pilot's units.

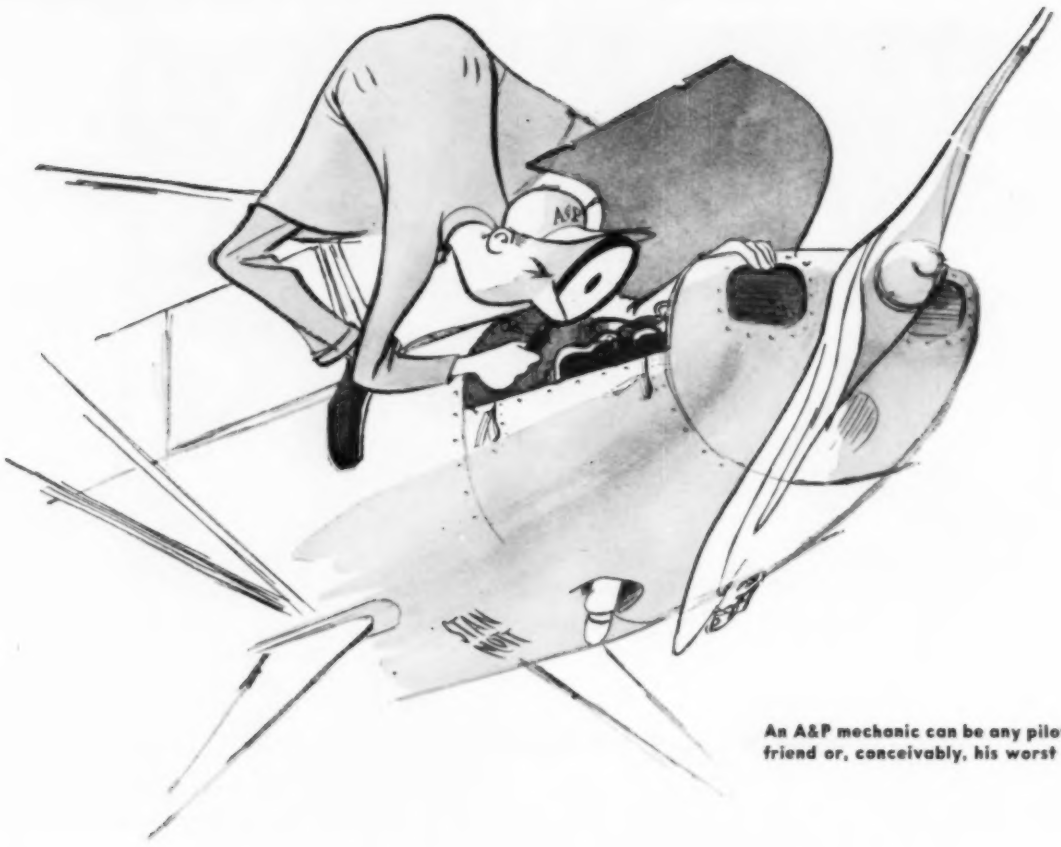
The dual axis autopilot draws a maximum of .04 amps. during level flight when not seeking a heading or altitude; maximum effort draws 1.5 amps.

The unit comes with a one-year unconditional warranty, with the gyros guaranteed for 90 days.

Mitchell Industries, which has been turning out automatic pilots at the rate of about two units a day during the past year, anticipates a broad market for its product. Estimating the potential in business aircraft in the neighborhood of 80,000, general sales manager Dan Thurman said the firm is setting its sights high. "We feel that if we are in the right place at the right time we can tap 60 per cent of that market," he told FLYING.

By the end of October 1960 Mitchell had sold 2,500 transistorized autopilots of all types (not counting Piper Aircraft units, which it also makes).

For the business or private pilot flying IFR alone, the automatic heading and altitude controls greatly simplify the task of flying the aircraft (*Continued on page* 90)



An A&P mechanic can be any pilot's best friend or, conceivably, his worst enemy.

Maintenance

IN THE GOOD OLD DAYS, a pilot was a mechanic, a designer, an engineer, a manufacturer. He flew experimental-test. He was a weatherman and an air traffic controller. He was everything. Today, though, a pilot can be all the others only with special training and signed certificates.

But the good old days aren't completely gone. For all practical purposes, the pilot-owner of a lightplane can be his own mechanic, even now. There is a line drawn by the Federal Aviation Agency beyond which a pilot must have an Airframe and Powerplant certificate to tinker alone with his flying machine. He can't legally tear his airplane down to the wheels and build it up again; but civil air regulations do leave him a little bit of elbow room.

For instance, as a pilot you can replace wheels and skis, prefabricated fuel lines, windows, safety belts, seats, shock cords, hose connections (except hydraulic ones), and bulbs and lenses in position and landing lights. You can paint any part of the exterior except balanced control surfaces, lubricate, reupholster, and patch fabric (unless you have rib stitching to perform or a control surface to remove). These and a few other operations fall under the definition of "preventive maintenance," and preventive maintenance you can do without having an A&P mechanic looking over your shoulder from the moment you open your toolbox.

If you want to take one step farther, and don't mind the A&P, you can perform practically any repair on your engine or airframe. Here the important definition is "direct supervision." If an A&P will check your work and sign his name in the aircraft log that the job has been performed satisfactorily, your work is as legal in the eyes of the FAA as a right hand traffic pattern around an amber light.

How much satisfaction you get from your work depends on the A&P you pick to supervise it. When you know just what you are doing, it is as uncomfortable to have him hanging over your shoulder as it is to have him in the coffee shop when you don't know which bolt to tighten next.

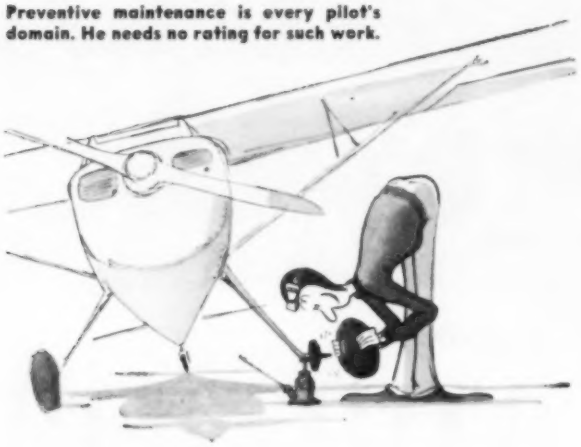
There is no standard fee for the services of an A&P, and it is a good idea to shop around among fees before you pick one. One mechanic may want five dollars an hour; another will be more than satisfied with a case of root beer.

Some things that seem as if they have been inadvertently left out of the regulation's list of preventive maintenance items have been deliberately omitted for a very good reason. Nicks in the propeller, for example. A nick looks like a very simple thing to get rid of, and it is. But so many variables enter into the question that

you almost need a degree in nick-reading to know how to handle each little depression in your propeller. A small nick near the tip of a metal propeller blade can be much more dangerous than a deeper one near the hub. One nick in the leading edge of the prop may not be critical, but if there's another one in line with it on the trailing edge, your propeller is seriously weakened.

Dents in the metal leading edge plate of a wooden prop are common and no cause for alarm; a nick in an aluminum alloy propeller can be filed out (under the watchful eye of your A&P); a nick in a steel propeller is a major concern and cause for a trip to the shop. There's more to this kind of maintenance than the uninformed pilot would suspect, and his preventive propeller maintenance consists of avoiding runups over dirt or gravel surfaces.

Preventive maintenance is every pilot's domain. He needs no rating for such work.



It's the same way with seemingly obvious repairs. One pilot was taking some friends for a look at the city from the air. He pulled the carburetor heat knob in his runup, and the rpm didn't even flicker, much less drop back the few hundred revolutions required. The pilot taxied back to the line and opened the cowling. There in plain sight was the carburetor heat control wire; it had slipped loose from its coupling under the cowl and needed only to be fitted back in place and a screw tightened to hold it there. His friends were impatient to get into that fabulous wild blue they had heard so much about. Glancing furtively around the field for inspectors, the pilot snatched the wire, fitted it in place and tightened the screw. The rpm fell back obediently on runup, and the flight was made without incident. It is possible that the carburetor heat control wasn't in just the same position that it was when the wire slipped out, but the runup showed that it wasn't very far off. The odds here weren't against the pilot, although his action was quite illegal.

Now take an almost identical situation and raise the odds just a little bit.

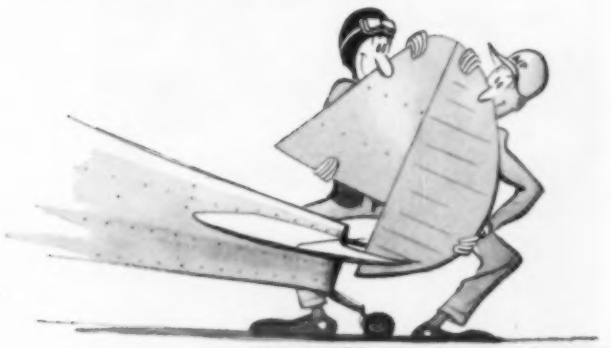
Once the cowl was open, the trouble was immediately apparent. The throttle linkage had dropped loose and was resting a few inches away from the carburetor. The

and the Pilot

Those good old days of pilot-performed airplane maintenance can still be here

By ROGER D. PALFREY

There are a few engine maintenance items that a pilot should be ready to perform.

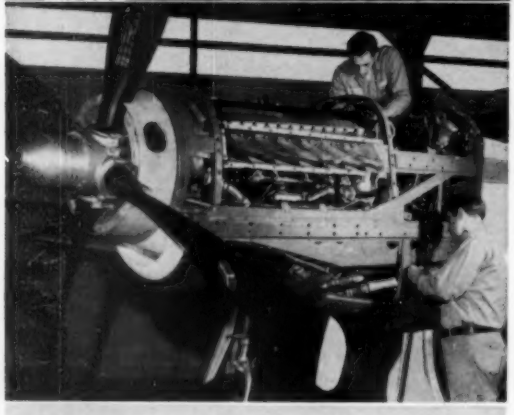


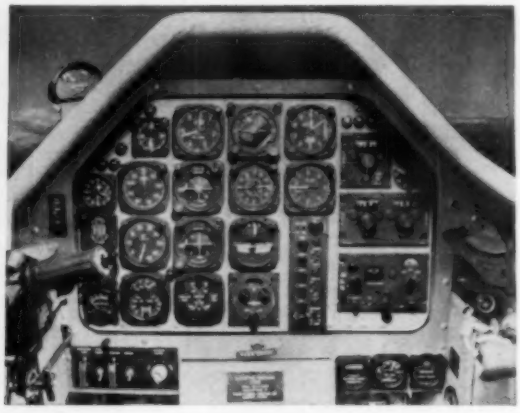
With an A&P at his side, there is almost no limit to maintenance a pilot can do.

pilot saw that it was simply a matter of replacing the linkage and tightening it, which he did. He didn't have any safety wire and you know the rest of the story. The connection loosened in flight, the engine slowed back to idle, and our pilot missed his forced landing. A simple thing like a loose throttle linkage gave that one pilot a problem that he wasn't quite able to solve.

When you lift the cowl without an A&P standing by, the only things that you can legally do are to check the general condition of the engine, the oil level, and replace the spark plugs or a pre- (*Continued on page 60*)

Below left: Cavalier before flight. Note retractable tailwheel, tinted canopy, radiator exhaust flaps. *Center:* Trans-Florida mechanics adjust 1,495-hp V-12 Merlin. *Top left:* Cavalier has tailored interior, retracting table for en route business. *Top right:* Instrument panel has navigation and communication radios mounted vertically to eliminate confusion, vertigo problems.





PILOT REPORT

CAVALIER 2000

He wanted a business airplane that could fly fast, high and far. "I'll start," he said, and he smiled, "with a Mustang..."

By RICHARD BACH

Cavalier makes a good cross-country airplane; former gun bays accommodate skis, golf clubs.

IT'S NO SECRET that Trans-Florida Aviation's Cavalier 2000 flies fast, or that it flies high, or that it flies far. You know this as soon as you know that the Cavalier 2000 is a cleaned-up, smoothed-up, completely remanufactured F-51 *Mustang*. But it couples high performance with very good slow flight and stall characteristics, and you don't have to be a red-hot fighter pilot to fly this unusual two-place business airplane.

To be more specific about its performance, the Cavalier has a redline airspeed of 490 mph, making it substantially faster than many conventional business aircraft and some light jets. With a 40,000-foot service ceiling, it can fly in bright sunshine over weather that would put many other airplanes on solid instruments for the greater part of a cross-country flight. With its 96-gallon tiptanks, it can fly a little bit farther than 2,000 miles nonstop, which means that it doesn't have to bother about touching down for fuel between Boston and New Orleans, or between Los Angeles and Atlanta, Georgia. If you're used to conventional single-engine and light twin pattern and stall speeds, you're already used to the Cavalier in the pattern. While she's most comfortable at 150 mph on downwind, she can be flown easily at 130. At low airspeeds she's as docile and responsive as a well trained show horse; she's over the fence at 105 mph and touches the runway at 86.

Manufactured at Trans-Florida Aviation's Sarasota, Florida plant, the Cavalier sells for $32,000 without radio. Fully equipped with communication and navigation radio, the price tag comes to $48,500. To date, seven aircraft have been sold, and inquiries of all types average ten a day.

For FLYING's evaluation, this editor flew the Cavalier some six hours, both dual and solo. Since I had thought of the Mustang as a wild and unforgiving wartime fighter, this airplane had a few pleasant surprises wrapped up and waiting for me.

At first glance, the cockpit of the Cavalier looks complicated, but an hour of cockpit time is more than enough to make it seem like home. The instrument panel and side consoles were designed by David B. Lindsay Jr., Trans-Florida's president, and to be perfectly truthful, the Cavalier's is the best-designed cockpit I have ever seen. All radios are mounted on the instrument panel; you need never turn your head to change frequencies of the ARN-6 ADF, the dual Collins Omni/ILS receivers, the Dare 360-channel crystal controlled VHF transceiver, or the Collins 17-L8A 90-channel crystal controlled VHF transmitter. All flight instruments are set in a tidy group at the top and center of the panel engine instruments cluster to the left, and the radio control panels are at the right.

The right forward console holds six short rows of toggle switches; the right aft console is home to 11 rows of circuit breakers, all accessible to the pilot. The left console carries gear and flap handles, the three trim wheels, carburetor heat controls, and the throttle quadrant. An engine starting control panel is set just beneath the engine instruments, and the fuel selector panel is between the pilot's knees, forward of the control stick.

Starting is simple: throttle open one inch, boost pump ON, battery ON (an external power unit also can be used), magneto switch to BOTH. You touch the starter switch and the sky turns. It takes a moment to see that it isn't the sky turning, but you're still impressed that the 12-foot Hamilton Standard 24D50 is a respectable bit of steel to put in motion with one switch.

On warm days only a touch of primer is needed, and as soon as the Packard-built (*Continued on page* 103)

JET GROWTH MARKS ARMY AVIATION

The Army's aggressive search for better mobility and ground support means a constant quest for new equipment and new tactics.

By LOU DAVIS

IF WE ARE to achieve mobility, then our ground forces must move via the air route—and, since it is air, Army aviation must engineer the job and supply the vehicles. Maximum air mobility for U. S. Army combat forces takes more than attainment of Army aviation's procurement goal of 6,500 aircraft and 12,000 pilot officers by 1970.

Out of the climbing budget—from $130,000,000, fiscal 1961, to $250,000,000 fiscal 1970—must come aggressive and continued research into all aspects of flight which set air mobility capability.

The Army's current target is to have 25 per cent mobility by 1970. Beyond that it wants ever increasing percentage until the ultimate—total airlift—is reached. To accomplish this broad mission takes vertical lift, field operational aircraft to lift one man or 100; adequate battle area, troop cover, surveillance and target selection capability; maximum effectiveness from aircrews and support personnel manning the vehicles; and economical airlift for bulk support logistics and supply. Last, but of overall importance, AA must be able to exercise management responsibility with support and confidence from others.

Probing these areas will advance the state of the art of flight itself and—of prime importance to the taxpayer and civil pilot-plane owner—will return important dividends to all aspects of civilian aviation.

Army aviation has been a prime mover in V/STOL flight for obvious reasons: its paramount need is for airlift that does not demand prepared runways and costly fixed base facilities covering acres of real estate. A truly practical air mobility for Army operations and combat means that all aircraft must be able to operate from cornpatches, bomb-cratered fields and forests; they

Fiat G.91 NATO fighter shows scope of Army search for aircraft. With a 5,000-lb-thrust Bristol Orpheus, speed tops Mach 1.

must be able to hurdle hill, dale, cities or roads.

Army research has been basic and consistent. Its total investment thus far amounts to more than $20,000,000—for its own testbed projects or joint service efforts. Its investigations include rotor, fixed-wing aircraft and wingless-rotorless vehicles such as the highly touted flying platforms and jeeps. Outstanding among its V/STOL testbed research work are: the McDonnell XV-1 autogyro (rotor-propeller) combination; the Bell XV-3 tilting rotor craft; the Vertol VZ-2 tiltwing; the Ryan VZ-3, deflected flap, vertiplane; the Doak VZ-4, rotating ducted fan system; and the Fairchild VZ-5 deflected flap and tilt wing. AA basic research management has joined forces with the Navy and the Air Force in funding flying platform test beds for the aerial jeeps and VTOL-like craft.

Above: Fiat's 650-mph G.91 light ground attack fighter now flies in Army colors. *Right:* Sikorsky H-34A flies with 42 rockets, nine machine guns, two 20-mm cannon. *Below:* Bell HU-1 Iroquois has six SS-11 guided anti-tank missiles.

These studies accent one all-important factor: operational problems associated with V/STOL field operations remains highly speculative even though they are

technically feasible to build and fly under "laboratory" conditions.

The Army Aircraft Review Board, headed by Lt. Gen. Gordon B. Rogers, deputy commander, Continental Army Command, which met last year, (FLYING, March '61) urged caution where V/STOL production aircraft effort is concerned until more has been learned about certain critical field operational problems—and until aviators and Army commanders are satisfied with the vehicles.

It spelled out these areas for scrutiny: effects of downwash velocities on vehicle stability; operational reliability and combat operations; complexity of control at zero speeds and other flight regimes; maintenance and suitability for efficient-reliable operation in battlefield environment. It believes realistic planning cannot move forward until answers are obtained on these vital points.

Brig. Gen. Clifton von Kann, head of Army aviation procurement and research, foresees little more than basic research and prototype testing activity in V/STOL before the turn of the decade. He does not wish to imply that his views are pessimistic, but he cites time schedules of present research projects—namely, the three-service STOL project soon to be contracted—which will not be able to produce useful design guidelines and other intelligence until 1965 or after. Following that, another five years will be needed to design, test and then submit for field evaluation, prototypes of production models.

He hastens to add that speedup of all or part of the V/STOL research can be accomplished if funds are made available by Army, Department of Defense and Congress.

In the meantime, the Army intends to place every penny possible into pushing ahead the frontier of slow speed, low-altitude flight and thus improve its overall combat capability. Through its work with NASA and industry, marked progress has been achieved: blade design for helicopters has been improved, rotor hubs have been simplified and made more reliable and less costly. "In all, efficiency has been increased by 50 per cent," according to Col. John D. Crowley Jr., chief of TRECOM, U. S. Army Transportation Research Directorate, at Fort Eustis, Virginia.

Lockheed Hummingbird design for Mach .85 speed plus hover capability.

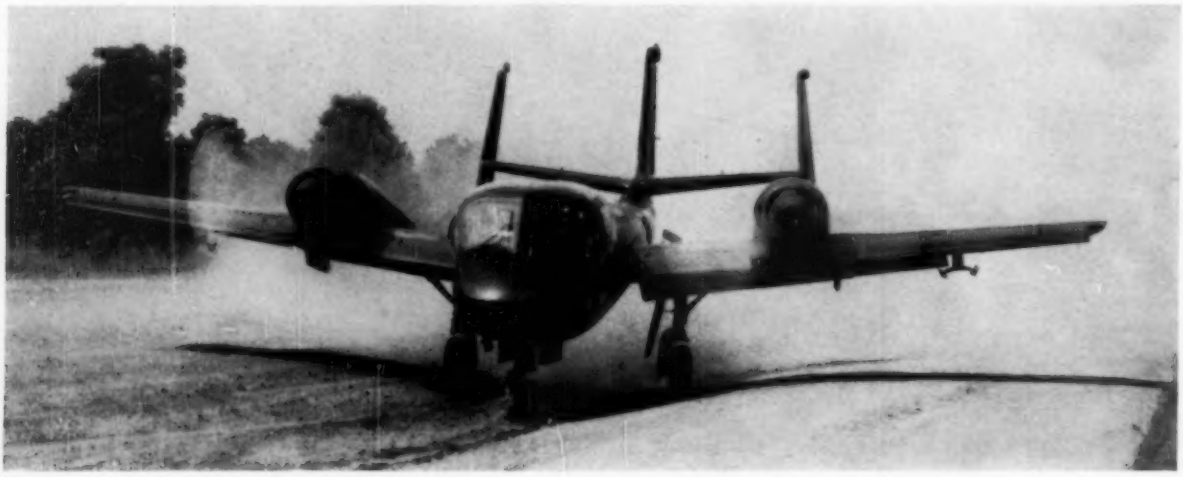
Approximately three-million dollars has been invested in applied research including 12 programs involving rotary wing vehicles, and low-speed flight studies by industry and NASA. Various work is being done to define rotor configuration and operational characteristics at 200-knot-plus speeds.

Advanced study projects include evaluations of Mach-2 rotor tip speeds for helicopters moving at 300 knots, lead-lag rotor design, blade propulsion through use of air jets at trailing edge of rotors (the Giravions-Dorand concept) and the Hughes hot cycle system.

Lead-lag rotor studies aimed at retreating blade stall indicate complex mechanical and aerodynamic problems. Operational use at the moment seems highly impractical. However, Sikorsky, NASA, Vertol and others are continuing to probe these areas.

The French company of Giravions-Dorand proposes a revolutionary system of (*Continued on page* 64)

Grumman Mohawk is a mainstay of Army minimum-field operation. The 316-mph transport can clear a 50-foot obstacle in 650 feet, land in 775.



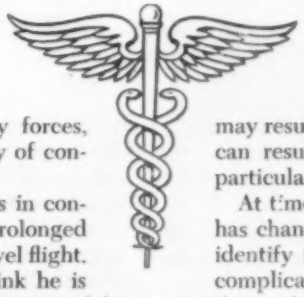
Beware of the false information your senses may give under various critical flight situations

THE MENACE OF PILOT VERTIGO

By JOHN T. FLYNN, M.D.

THE MOST DIFFICULT adjustment that the pilot must make as he acquires increasing flying skill is his willingness to believe that under certain circumstances his senses can be wrong. Perhaps hardest to accept is the knowledge that at times the equilibrium organs of his inner ears cannot tell him his true position and motions during flight, when his view of the earth or other stable reference is cut off. Pilot's vertigo, or loss of his orientation in space, is more difficult to combat when the pilot lacks a basic understanding of the problems involved.

Put a man on an unstable moving platform at altitude, cut off his vision of the earth or horizon or other stable reference, submit him to accelerations and centrifugal force greater than usual which he cannot distinguish from gravity forces, and the result will be a numberless variety of confusing vertigo experiences.



In a level turn, the pilot may think he is in continued straight flight, or climbing. In a prolonged turn, he may believe he is in straight and level flight. In recovery from a level turn, he may think he is descending from altitude. In a left-hand turn, if he suddenly bends his head forward, he may feel he is falling to the right; and vice versa.

Repeated small corrections of controls to maintain straight and level flight may eventually create a sensation of gradual turning. The pilot may misinterpret the degree of bank or have a false sensation of tilting when in a skid or slip. In loops and turns, the pilot may think he is upright, when he is actually inverted. In very gradual climbs or descents, the pilot may believe that he is flying straight and level. Entering a slow bank may still permit the wrong impression of level flight; as airspeed builds up, the pilot thinks he is entering a dive, pulls back on the control column, thus tightening the turn and locking him tightly in a graveyard spiral.

If turbulence causes an abrupt roll to the left and the aircraft slowly recovers to horizontal level flight, the pilot may not be aware of the recovery from the tilt. Feeling that the plane is still tipped to the left, he may lean far to the right and have difficulty in forcing himself out of this position even when he knows that his instruments show straight and level flight.

If the aircraft rolls very slowly to the left, the pilot may not be aware of this and think that the aircraft is still straight and level. Rapid recovery of the aircraft to true horizontal may make the pilot believe that it is tilted to the right, so that he leans to the left to correct his sensation. Attacks of "the leans" are not uncommon when weaving back and forth slightly on the feather-edge of radio beams.

If the aircraft pitches upward in turbulence less than 20 degrees and recovers slowly, the pilot may still feel that the aircraft is climbing steeply; or if the pitch is downward, a false sensation of diving may continue after slow recovery to horizontal flight, so that the pilot pulls back on the stick and enters a steep climb.

In a coordinated turn, acceleration (centrifugal) forces press the body firmly into the seat, similarly to a climb or a pullout from a dive. Hence, when the earth or horizon is cut off from vision, the pilot in a banked turn may think he is in a climb and may operate the controls improperly. When a banked turn is completed and the aircraft brought into straight and level, the lessened pressure on the "seat of the pants" resembles that of entering a dive. This may cause the pilot to pull back on the control column and put the aircraft into a stall. Also, at the end of a pullout from a dive, the downward pressure against the seat is lessened; the pilot may interpret this as an entry into another dive.

During a skidding turn, the body is pressed away from the direction of turning, creating the impression that the aircraft is tilted in the opposite direction.

In recovery from a spin, when sight of the earth is cut off, the pilot may have the sensation of spinning in the opposite direction, hence put the aircraft back into the original spin. A "graveyard spin" may result, especially when the spin is inverted, and can result in a crash in perfectly clear weather, particularly in high performance aircraft.

At times, the pilot may be aware that the aircraft has changed position or attitude, but be unable to identify the direction or degree of the change. A complicated series of maneuvers may leave him utterly confused and quite unable to reorient himself and his aircraft.

These types of spatial disorientation occur most often in instrument conditions, and with poor visibility as in rain or fog. They are three to five times more common at night and are aggravated by other conditions: lack of instrument experience, attempts to mix VFR and IFR flying, inexperience with the particular aircraft or with a specific flight situation, (*Continued on page* 60)

CORONADO AIRPORT

New Mexico's Haven of General Aviation

By GEORGE MASON

GENERAL aviation faced a dim future in Albuquerque, N. M., in 1959. Its municipal airport, sharing civilian operations with the military, totaled 319,459 aircraft movements that year. Congestion and frightening volume of air traffic were throttling the growth of general aviation in an area where distances are great, flying weather perfect all year around and the economic climate exceptionally favorable to the growth of private flying.

Albuquerque Municipal Airport and Kirtland AFB are one and the same. Runways are owned, maintained and operated by the Air Force while the city of Albuquerque has only 31 acres available for commercial and general aviation activities.

B-58 test missions, experimental high-altitude landings and takeoffs by Boeing 707s and Convair 880s, military missions and regular airline schedules compete heavily for air space surrounding the airport.

What chance, pilots asked themselves, did the little fellow have in such a bee-hive? In addition to the understandable reluctance of Albuquerque's future pilots and plane owners, more and more executive aircraft owners were overflying the city to avoid the aerial badminton game.

Finally the people and the city government recognized the problem. In the Albuquerque Chamber of Commerce, a dynamic aviation committee attracted such private flying champions as Joe Wilson, head of Aviation, Inc.; Clark M. Carr, head of Carco Air Service; and William P. Cutter, founder of the Cutter-Carr Flying Service and dean of New Mexico's general aviation executives.

The Albuquerque City Commission appointed an airport advisory board, headed by Ralph S. Trigg, a prominent civic leader with business connections in the petroleum and life insurance fields. The Advisory Board appointed a young architect, William E. Burk Jr., to draw up a master plan that was approved by the Chamber's Aviation Committee.

But all was not peaches and cream. One faction wanted a municipal airport west of the city that would free commercial and general aviation from all Air Force ties. Such a facility would cost the city taxpayers more than $11 million and the community was not in condition to put up such a sum.

Joe Wilson, a vigorous and sincere man with a fierce dedication to private flying, rallied a visionary group of citizens about him, and together they rose to fight the measure that was doomed to defeat, and that threatened to take Albuquerque general aviation with it.

Wilson and his associates realized that their plans could not be a crusading charity drive, but had to be translated into something economically sound. And so was born the first idea of the magnificent new Coronado Airport.

These men were convinced they were on the right track on June 15, 1960, when architect William Burk's interim report on site selection had this to say: "A significant development in the history of general aviation in the Albuquerque area will be the completion of the Coronado Airport."

The Coronado Airport development took most of the pressure off for the $11 million airport on the West Mesa and everyone concerned was more than willing to concentrate on another plan for a three million dollar renovation of the present municipal site. The taxpayers, in effect, had saved themselves eight million dollars by architect Burk's master plan and the Coronado project. And Coronado was designed so that it will care for the community's general aviation needs for many years to come. There was no government subsidy involved at Coronado. Its stockholders are principally responsible businessmen who believe in the profit potential of a private airport operation.

Today the Coronado Airport represents nearly a million dollars, the largest sum ever committed to a general aviation project in the history of New Mexico. Happily, Coronado Airport has been a profitable proposition from the first day its paved and lighted runways were opened in September, 1960. Almost overnight, half of Albu-

Hemmed by B-58s, crushed by 880s and 707s, lightplanes shied from Albuquerque Municipal Airport. Here's what happened

Below: Cessna aircraft on continuous display in pilots' lounge.

Above: Coronado Airport. Nearest obstruction to flight is 70 miles away.

Above: Visitors view Coronado's modern terminal, executive aircraft.

querque's roster of over 200 privately owned aircraft moved to Coronado, leaving the municipal airport primarily to the commercial and military traffic and also thinning out crowded conditions at three nearby fields.

In selecting the site for Coronado, the Aviation Inc. management considered many locations. In bygone years the original premise for an industrial site was its proximity to a railroad. Today proximity to an airport is just as important.

The site finally selected is a dream location. It is only four miles north of the Albuquerque city limits on the new super-highway that links Albuquerque with New Mexico's historic capitol, Santa Fe. The Alameda interchange is immediately north of Coronado, providing easy access from the airport to the high speed road. Industrial Albuquerque is (*Continued on page* 74)

SPERRY

INDUSTRIAL GIANT OF THE AIR AGE

Sparrow, Sperry's supersonic air-to-air missile, was mounted on Douglas F3D Skynight in May, 1954.

PART IV

Through turbulent years, a second world war, and a country's diversified air commerce, Elmer Sperry's ideas kept growing

By GILL ROBB WILSON

THE years 1928-'29 were an exciting period in the building of American airpower. Sperry Gyroscope's sale at that time to the North American Aviation Corporation for some four million dollars was but one of many such rearrangements. The industry-wide changes constituted an introduction of the whole aviation potential to the investor market. Lindbergh's flight had spotlighted that potential.

Never was a stage better set for such an introduction. The country was in a boom era—"Don't sell America short"—"A car in every garage and a chicken in every pot."

The new planes, engines and instruments were thrilling—the Whirlwind-powered Bellanca, the Wasp-powered Vega, the tri-motored Fords, Fokkers and Boeing 80A, the Travel Air "Mystery." Dick Byrd and his crew made it from Little America to the South Pole and back. Apollo Soucek coaxed a Wright Apache to almost 40,000 feet. Jimmie Doolittle demonstrated fully instrumented flight in a Consolidated. Nick Mamer and Art Walker refueling aloft flew in a Buhl monoplane, the "Spokane Sun God," non-stop from Spokane, Wash. to New York and return. The pilot fraternity kept aviation in the headlines—faster, higher, farther, more dependable, more precise—Eddie Stinson, Art Goebel, Lew Yancey, Harry Tucker, Frank Hawks, Kingsford Smith, Wiley Post, et al. Mel Pride landed the first fighter on the USS Lexington and Mark Mitscher the first on the venerated "Sara". Sperry instrumentation was behind much of the improved capability of the airplane.

Federal stabilization of civil aviation began to give substance to air commerce—a Safety Board—airport rating regulations—airworthiness requirements—transport pilot qualifications. A department of licensing and inspection took form. The Bureau of Air Commerce received the 1928 Collier Trophy for development of airway and navigation facilities. "N" became the U.S. prefix in international license coding.

T.A.T. hooked up with the railroads to provide 48-hour coast-to-coast passenger service. W. R. Grace and Co. joined with Pan American to form Pan American-Grace Airways. Randolph AFB and the Wright Field Experimental Laboratory were authorized. National Air Races, Reliability Tours and Aircraft shows blossomed in Detroit, Cleveland, Chicago, St. Louis, Los Angeles.

More pertinent still was the explosive nature of the industry. The flood of new corporations and formation of great holding companies indicated that aviation had broken through to major economic stature.

United Aircraft and Transport Co. was formed—a complex sponsored by the National City Bank of New York. Into this holding was gathered the Boeing Airplane Co., Pratt and Whitney, Hamilton Metal Plane Co., Sikorski, Northrop, Chance Vought, Stearman, Pacific Air Transport, Boeing Air Transport, Stout Airlines, Boeing School of Aeronautics and a handful of Boeing subsidiaries in Canada.

The Detroit Aircraft Corporation was organized and under its umbrella came Lockheed, Ryan, Eastman, Winton, Blackburn, Marine Aircraft Corp. and Aircraft Development Corp., all important concerns of the time.

A third combination was the Curtiss-Wright Corporation. Here was collected Curtiss Aeroplane and Motor Co., Wright Aeronautical Corp., Curtiss-Caproni Corp., Curtiss-Robertson Airplane Mfg. Co., Keystone Aircraft Corp., Moth Aircraft Corp., Travel Air Co., and the Curtiss-Wright Flying Service.

A fourth combine was Aviation Corp. including Fairchild Airplane Mfg. Corp., Fairchild Aerial Camera Corp., Fairchild Aerial Surveys Inc., Fairchild Engine Corp., S. M. Fairchild Flying Corp. and Fairchild Aircraft Ltd. of Canada.

Not all of the aviation industry was brought into combinations, but scarcely any major elements failed to react to their trend. Douglas reorganized and expanded to Santa Monica. Martin moved to Baltimore and expanded. Consolidated bought Thomas-Morse and expanded. Atlantic Aviation Corp. became Fokker Aircraft Corp. and erected new plants in West Virginia, New Jersey and California. Keystone had acquired the Loening Aero Engineering Corporation. Fairchild had bought Kreider-Reisner. Additionally, scores of new companies threw their hats into the ring—Cessna, Spartan, Aeromarine-Klemm, Pitcairn Autogyro, Mono-Aircraft, Aeronca, Buhl, Great Lakes, ad infinitum. C. G. Taylor and Bill Piper combined to herald the light plane era with the "Chummy".

The C-11 gyrosyn compass system is in wide use by polar-flying aircraft. When magnetic headings are unreliable, directional gyro remains accurate.

Such was the context of the times in which Elmer Sperry sold his company.

When in 1929 Sperry Gyro became a corporate unit of North American, Tom Morgan, then general manager, became president of the company. Dr. Sperry had indoctrinated Tom into science engineering but Morgan needed no indoctrination in human engineering. He had a genius for people. Sperry Gyro also had an intra-company discipline reminiscent of military organization at its best. Gillmor was the genius behind this. Responsible people had freedom of judgment and action but responsibility for results was definitely theirs.

However, neither its human engineering nor its philosophy of organization would have availed Sperry Gyroscope had it not been for the ability of the research and engineering teams to translate scientific concept into mechanical reality. Led by Preston Basset, the Sperry brothers and others, the professional corps of the company gave management a continuous range of progressive mechanisms to sell, and Sperry's sales organization led by Bob Lea was more nearly a customer service than a merchandising project.

To digress a bit, some early Sperry men went it on their own. After Lawrence's death, Dr. Sperry leased manufacturing rights of aircraft instruments to Charles Colvin, Morris Titterington and Brice Goldsborough. When the latter two died, Colvin sold to Bendix and thus the line of Bendix flight instruments received impetus and developed its own notable products.

The original of all Sperrymen had been Hannibal Ford, who had helped in development of the Gyro compass. Ford left Sperry in 1915 to establish Ford Instrument Company, concentrating on Navy's problems in gunfire control.

Another early Sperryman was Carl Norden. Norden had worked on the first guided missile project. He set up business for himself and concentrated on the bombsight which was to bear his name.

In North American, Sperry Gyro became one of a family which included Curtiss Aeroplane & Motor, Wright Aeronautical, B/J Aircraft, Intercontinent Aviation, Western Air Express, Transcontinental Air Transport, and Pitcairn.

Within several years fol- (*Continued on page* 70)

A Boeing B-17F drone equipped with Sperry's remote control command guidance system lands after a test at Eglin Air Force Base, Florida.

BY THE LIGHT OF THE MOON

NIGHT FLYING is on the upsweep! Each year more pilots are flying their airplanes after sundown to obtain more utility—or as they say in business circles, to receive more of a return on their investment. Some pilots report a 25 to 50 per cent increase in the use of their aircraft after making a decision to fly "by the light of the moon."

Other advantages include a more flexible schedule during the day so that business meetings or other activities need not be rushed or broken off to permit the return flight during daylight; and a direct savings in overnight hotel costs, meals, and hangar fees. Or, if a pilot wishes, he can leave his home base the evening before, get a good night's sleep at his destination and make an early appointment, fresh and clear-headed.

On the flying side, the night ride usually is in smoother air, cabin temperatures are cooler and more comfortable, and the glare of the sun is eliminated. In addition, a decrease in the usual daytime haze and turbulence can be expected.

Of course, whether single-engine aircraft should be flown at night is up to the individual, but once the decision has been made—and this also applies to the pilot who decides to fly at night with two engines—it will be found that after-dark flying is not difficult, but it is *different*. Also the pilot will find that night flying calls for more proficiency than day VFR. In brief, in order to handle any dark-night situations, a pilot should be able to:

1. Control the aircraft by reference to the flight instruments.
2. Determine the aircraft's position by use of radio aids to navigation.

Such skills can be acquired by dual instruction, and by a thorough night flying checkout by a competent instructor. However, it is the actual night flying experience on cross-country flights which builds confidence and sharpens a pilot's technique. Here are some tips which can help make night cross-country flight an interesting, satisfying experience.

Night flying isn't any more difficult than day flying, but it is different. Here are some things to know if you're thinking about pushing into the black

By TED DUROSKO

THE PRO'S NEST

• *Pre-flight inspection*—Make it a habit to file your flight plan after the completion of the preflight inspection rather than prior to it. If the inspection is "made under pressure" to meet a designated takeoff time, some items can be missed or not checked out as thoroughly as required.

Remember that in addition to a standard preflight inspection, the position lights and rotating beacon should be turned on and checked individually by the pilot. Inside the cockpit, panel and cockpit lights should be checked and then adjusted for just enough illumination to read the instruments comfortably and yet cause no glare. Full illumination of panel or cockpit lights can cause reflections on the windows and windshield which can interfere seriously with the pilot's outside vision. Also included in the preflight inspection is a check of the taxi and landing lights—just a flick of the landing light switch when on the ground because the plexiglass window in the leading edge of the wing requires a good flow of air over it to dissipate the heat generated by the powerful sealed lamp.

Be sure to include a flashlight as part of the night flying equipment. Preferred is the type with color control—the white light to be used when performing the preflight, and the red light for emergency or supplemental lighting in the cockpit when in flight.

• *Night acclimation of the eyes*—After the preflight inspection has been completed and the flight plan filed, the next item of concern is night acclimation of the eyes. The amount of time to develop "night vision" varies with individuals, but usually is between 20 minutes to one hour.

Avoid looking directly into any bright light, especially when taxiing out for takeoff, and for best results in high vision, pass your eyes slowly back and forth across the object or area under observation. If it becomes necessary to look into a bright light, do so rapidly, or better still, use only one eye; the "unexposed" or covered eye will see in the dark independently when you reopen it in a darkened area.

Also use this "one eye technique" if you light up a cigarette when in flight, or if it is necessary to turn on a white light in the cabin for a few seconds. Red light, however, will not harm night vision.

• *Takeoff*—When cleared into the takeoff position, it is desirable to taxi a few feet forward beyond the turn in order to allow the nose wheel or tail wheel (whichever the case) to straighten out. Also this short forward movement can be used to align the airplane with the runway lights. Just prior to (*Continued on page* 94)

Accidents draw a heavy penalty in both lives and aircraft, equalling many another nation's entire air force. How war is waged against this menace

By MAJ. GEN. PERRY B. GRIFFITH

Flying safety in the Air Force

Maj. Gen. Perry B. Griffith develops AF safety requirements, programs.

IN THE PAST 10 years, despite a rapidly declining aircraft accident rate, this nation lost through accidents alone a larger Air Force than exists in many other countries in the world.

During one segment of that 10-year period—the first half of 1959—the U.S. Air Force trained 1,444 new pilots. In the same six months aircraft mishaps killed 110 pilots and caused major injuries to 55 others.

Seven hundred and five aircraft were accepted into the inventory during that six-month period. At the same time 271 were destroyed in accidents. This obviously means that the aircraft industry was working at an effective level of 62 per cent, because 38 per cent of what they produced was being destroyed *accidentally!* And we are talking here about the first six months of 1959, a time when the USAF reached a rate of 9.3 major accidents per 100,000 flying hours!

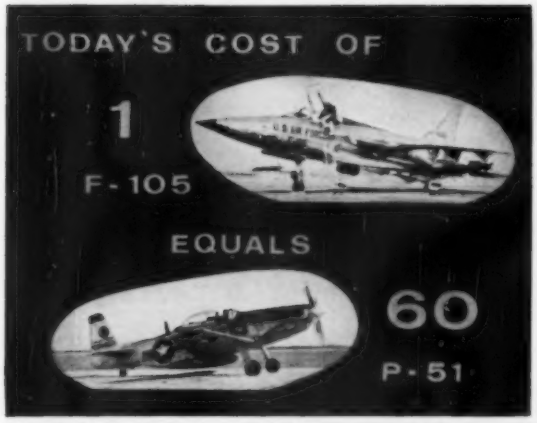
Appalling as these statistics are, they represent an enormous improvement over those recorded earlier in Air Force history. For example, the major accident rate in 1947 was 44 per 100,000 hours. Consider what the statistics on pilots killed and aircraft destroyed would have been in 1960 if the rate had been 44 rather than the 5.8 actually recorded! The contrast is dramatic.

As professions go, I guess military flying must be considered a hazardous occupation. But paradoxically, in the past 18 years, during which our equipment increased fantastically in complexity, handling characteristics and speed, and thus inevitably in its demands on our pilots, the hazard of military flying actually has decreased dramatically. In 1942, a young pilot just out of flying school could expect to fly 1,400 hours before he had a major aircraft accident. In 1960, the brand new Air Force pilot could anticipate flying 17,000 hours before the odds were against him.

This has come about not through coincidence or good luck, but as the result of aggressive aircraft accident prevention—flying safety.

Most of us think of safety programs in terms of humanitarianism. None of us can accept needless loss of life through avoidable accidents. But, basic as it may be to our culture, humanitarianism is by no means the Air Force's only interest in accident prevention.

To understand how vital the safety program is to our air defense capabilities, consider for a moment another bit of history: The major accident rate trend in 1921



The plummeting aircraft accident rate achieved by the USAF has enabled it to counterbalance the skyrocketing cost of aircraft.

was 506 accidents per 100,000 flying hours. The period we customarily use for the Air Force today, however, is that between 1947 and 1960—*the jet age*. In 1947 we were experiencing 44 major accidents per 100,000 flying hours.

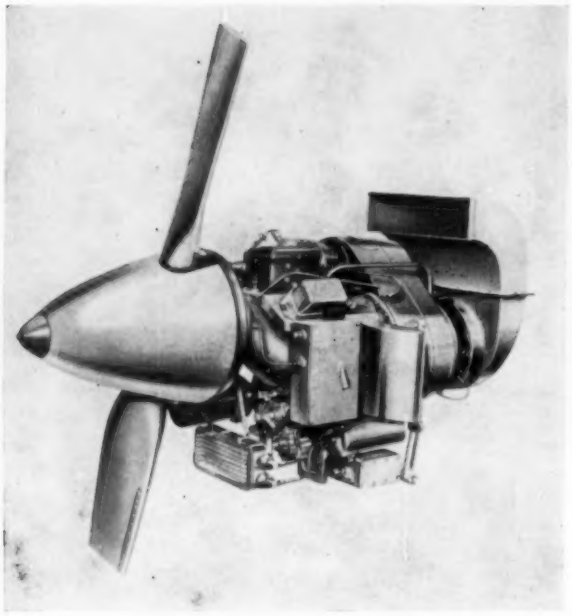
But in 1960 the rate fell to a record low of 5.8 per 100,000 hours. And pilot fatalities in 1960 were down to 1.7 per 100,000 flying hours. Comparing 1960 with 1959, we find that our major accident rate is down 29 per cent; aircraft destroyed down 33 per cent; and total fatalities down 18 per cent. The Air Force has not been involved in a mid-air collision with a civilian transport since May 1958. In-flight mishaps involving Air Force planes (for the most part, aircraft flying in formation or on operational rendezvous such as in-flight refueling) dropped from 32 in 1958 and 27 in 1959 to only 15 in 1960, an overall reduction of 53 per cent.

The Air Force is justifiably proud of this achievement. Yet, it must be emphasized that these figures do not tell the whole story. For in 1947, when our rate was 44 accidents per 100,000 hours, only one-third of the aircraft involved in aircraft accidents were destroyed. And for the price of one present-day fighter aircraft—the F-105 fully equipped—we could have bought 60 F-51 Mustangs vintage World War II.

Therefore, no great dollar savings can be shown as a result of our intense, and successful, aircraft accident prevention program. What can be shown is far more important: If the 1947 rate of 44 major accidents per 100,000 hours had continued (*Continued on page* 100)

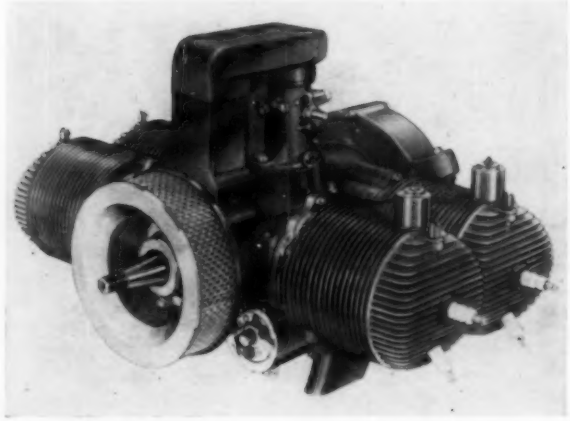
NEWSREEL

AVIAMILANO P-19 *(Right)*. Two-place training plane for Italian aero clubs comes with tricycle or conventional landing gear. The steel-tube, wood and fabric aircraft stalls flaps-down at 35 mph, has a maximum airspeed of 124 mph, and cruises at 111 mph. Powered by a 90-hp Continental, the P-19 has a 750 fpm sea-level rate of climb and ceiling of 13,500 ft.



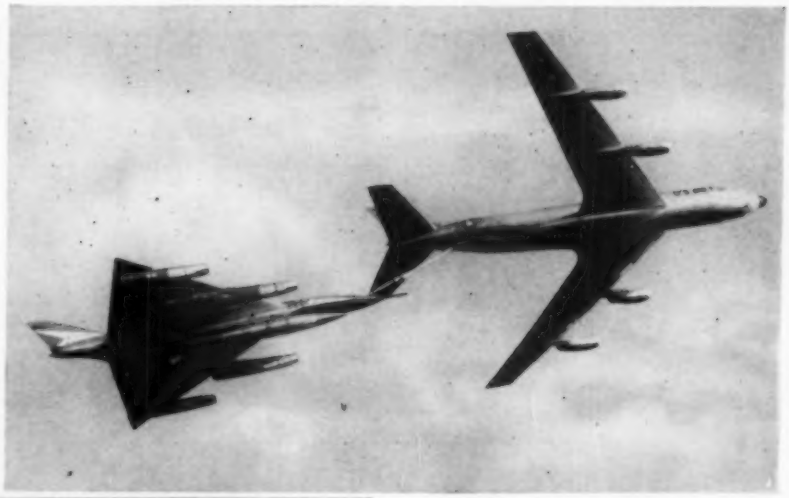
WORLD'S SMALLEST TURBOPROP ENGINE *(Left)*. Built by the Rover Company, the 90-hp engine weighs 235 pounds, is 30 inches long. Equipped with its own automatic variable pitch propeller, the little powerplant first flew in a single-seat "Currie Wot" biplane *(above)*, at Elmdon Airport, Birmingham, England. It fits small aircraft without major modification to airframes, burns 19 gallons of kerosene or diesel fuel per hour at maximum cruise. Rover's engine, also available in 60 hp, is byproduct of their research into small gas turbines for automobile use.

VICTA AIR TOURER *(Below)*. Winner of the 1953 all-British light aircraft design competition, this Australian lightplane has a redline airspeed of 196 mph, cruises at 115 mph, and stalls at 49 mph flaps down. The all-metal, 1,300-pound airplane climbs at 900 fpm, has a 600-mile range, is powered by 90-hp Continental and Sensenich metal propeller.



NEW ENGINE *(Above)*. The first two-cycle reciprocating engine to be type-certificated by the FAA for small helicopters and fixed-wing aircraft was announced by the Nelson Specialty Corporation, San Leandro, Calif. Helicopter version weighs 76 pounds, delivers 43 hp at 4,000 rpm; fixed-wing model weighs 67 pounds, delivers 48 hp at 4,400 rpm. The engine is used in Hiller helicopters and Goodyear Inflatoplanes.

NEWSREEL



RECORD HOLDER *(Right)*. Shown here slowed to keep pace with a 600-mph Boeing KC-135, the Strategic Air Command's Convair B-58 Hustler recently set six official world speed records. During the speed runs, SAC's operational supersonic bomber averaged 1,200 mph, reached a top speed of 1,430 mph. With the tanker, Hustler's range is "intercontinental."

FIAT 7002 *(Left)*. The first Italian helicopter designed on the "cold jet" principle took to the air on its maiden flight January 26. The rotor is powered by a Fiat 4700 free turbine air generator, which ducts compressed air to the rotor tips. Fiat called the flight "fully satisfactory."

VARIABLE CAMBER PROPELLER *(Below)*. Designed and manufactured by the Hamilton Standard division of the United Aircraft Corporation, this 15-foot propeller, shown here in tests at Windsor Locks, uses two sets of blades working in pairs. Installation of the unusual propeller on VTOL aircraft would increase payload 50 per cent, range 40 per cent. It is being tested at Wright-Patterson AFB, Dayton.

VERTICAL RISER *(Below)*. Republic Aviation's yet-unnamed VTOL transport design was disclosed as a practical means of troop and cargo carrying from undeveloped areas. Powered by six J85 turbojet engines, the craft would cruise at 400 mph, have a maximum range near 3,000 miles, and a service ceiling of 36,000 feet. Redline airspeed is 520 mph.

Left: Mike Ligeros in the cockpit of the Bonanza. All tools necessary for repairs are kept permanently in the aircraft. *Below:* The Denver service center. As many as 50 calls for help come here each year from stranded refrigerator trucks.

Servicing refrigerator trucks by airplane is a lucrative business for this enterprising concern

By ROBERT A. LATIMER

"Flying Repair Shop"

MIKE LIGEROS, of Denver, Colorado, is an ex-fighter pilot who is still "scrambling" to meet emergencies. Instead of enemy bombers, however, Ligeros' scrambles today are long-distance phone calls from drivers of refrigerated transports which have broken down somewhere along the highway.

Ligeros is a Thermo-King truck refrigeration equipment dealer, servicing a huge area in the Mountain States. His chief product is the package refrigeration unit seen on the fronts of refrigerated trailers, directly above the cab, which use tiny gasoline engines to maintain below-freezing temperatures over long cross-country hauls.

When the former fighter pilot went into this business, he knew that the most serious problem likely to confront long-range shippers of produce, was sudden refrigeration failure. Payloads worth $10,000 or more could spoil in a matter of a few hours. Thus, it occurred to him that guaranteeing 200-mile-an-hour service from his Denver, Colo. headquarters would sell a lot of additional truck refrigeration equipment.

That was in 1958, when he was servicing his 10-state market by conventional-truck methods. An active pilot who had kept his instrument ticket current, Ligeros studied the possibilities of servicing the refrigeration units by air, even in the most remote parts of the territory, and came to the conclusion that he could land within a reasonable distance of almost any breakdown. A lightweight motor scooter, built at a cost of around $200 in Ligeros' own shop, proved the ideal solution to the last link between the flying repair shop and the disabled truck itself.

Now, having made as many as 50 airborne service calls each year, Ligeros has built up his truck refrigeration business so spectacularly that it has grown from a one-man operation in a small 1,200-square-foot shop in Denver's "Truck Row" to a new 10,000-square-foot shop and salesroom in Denver, plus a distributorship in Salt Lake City. "The airplane was the key to the whole thing," Ligeros said. "Once we proved that direct-by-air repair service was feasible, truckers who had been using dry ice, cold-plates, or other refrigeration methods, showed little resistance to installing a lower-cost, more controllable power-driven refrigeration system."

Ligeros uses a Beech Bonanza for his airborne repair shop. Permanently carried in the aircraft are all basic tools for refrigeration repairs, replacement parts for compressors, motors, drive belts, solenoids, fractional horsepower gas engines, etc. Included, of course, is the motor scooter, which makes a double trip in most instances to get the right tools and equipment to the right place when a truck loaded with valuable perishables has reported refrigeration troubles.

The average trip is around two hours' flying time, which means a flight of from 350 to 450 miles, saving low-temperature loads throughout Colorado, Kansas, Nebraska, Montana, Wyoming, New Mexico, Idaho, Utah, Arizona and Nevada. END

UNPARALLELED STABILITY . . .

The Aero Commander is designed to work for the pilot. Superior stability is the fundamental function of Aero Commander's high wing, high empennage design. The airfoil contour of the speed-line nacelles minimizes airflow separation. The high tail surfaces move smoothly through undisturbed air. Result: superior airworthiness, maximum stability at all speeds. This amazing 'hands-off' stability is just one of the reasons why the pilot flies so effortlessly in the new Aero Commander.

Write for your copy of the new Aero Commander brochure which describes in detail models 500A, 500B, 560F and 680F.

AERO COMMANDER *offers the best combination of features essential to business flying*

AERO COMMANDER, INC, Bethany, Oklahoma, *subsidiary of Rockwell-Standard Corporation*

NO. 251

I learned about flying from that!

To help a friend is only natural, but when that means night, no compass, no radio, one unlighted runway marker . . .

By AUGUST J. HERBSTREITH

FEW PILOTS EVER flew that didn't sometime become lost, embarrassed or downright scared; however, it is rare that all three take place on the same night, as happened to me. Michigan has many cold winter days, and it was one of these that Jim, a friend of mine, had picked to come home on a weekend pass from Fort Knox.

It was dark at 5:30 that night when the phone rang. I answered to hear his worried voice: would I fly him to Kentucky? He was going on maneuvers the next morning and he had to be back at 1:00 a.m.

I have always liked to fly at night, yet after every flight I tell myself, never again in a single-engine plane. The thought of flying 300 miles with only navigation lights and a LF transceiver made cold chills run up my back. I was thinking of the only ship I could get at this time of night, a PA-14 Family Cruiser. I had flown it in from Valparaiso, Indiana, the week before. Though it had a new license, I could think of many reasons why I should not make this flight.

Despite my misgivings, by 6:50 we were VFR from Grand Rapids on a hurried flight plan, ETA 10:25 at Louisville. I had planned to fly south over Indianapolis, then to Louisville using my compass, light beacons for pilotage and low frequency ranges in case any trouble should develop.

On the Piper Cruiser the compass is not on the instrument panel but above it, and I used the flashlight to check our heading every few minutes. We had been airborne some 20 minutes when my buddy called my attention to the fact that we were going southwest by compass. As the road beneath us ran due south, I deduced that we had a compass error. Right then I wanted to go back home. Without the ship I had wanted or a reliable omni, I shun night flying, but my buddy insisted that we continue. He had to make those maneuvers now or it would be two weeks before he could join his company. He must be on the base by 1:00 a.m.; after that time he would be AWOL. I couldn't let him down when he was depending on me.

We flew a compass rose and I made a temporary compass card. The errors were very erratic, as much as 45 degrees off on the 180-degree heading. However, we resumed our new heading, and not knowing that this was just the calm before the storm, we continued blithely on our flight.

The checkpoints came up right on time, and the beacons were all properly placed, including the cluster of stars I was watching through a light overcast. Jim began telling me how foolish it would have been to go back, like the fellow who swam half-way across a lake, thought he couldn't make it and swam back. By the time Indianapolis passed on my right wing I had conceded he was right.

It was after this that things began to happen. First the check-points showed up at the wrong times. Then our mike carrier stuck, cutting out our receiver. I disconnected the mike, only to find the night drain on our battery had reduced our receiver to static and garbled weather reports. As if these were not enough, the stars I had been watching in the south faded behind thick cloud layers.

"Well," I thought, "things could be worse." I looked down at the dark small towns we were over, and decided to fly another hour, land at a small night field to our bearings, and make the remaining short hop to Louisville.

At 10:30 our left tank was dry. I switched to the right, which was at least a third full.

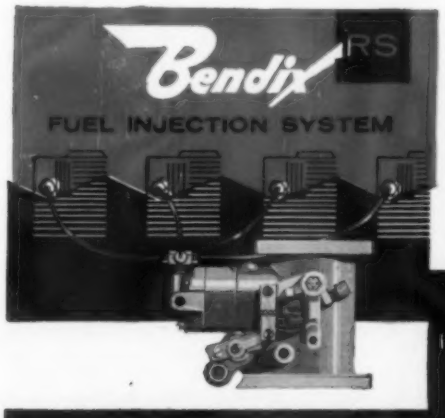
Soon a clear field appeared below us right on course, with runways near the administration building. I chopped the throttle, made a 45-degree bank and came in as smooth as glass.

Since I was not sure what field we were on, I cautioned Jim to let me do the talking. This arranged, we walked in and asked for the gas truck. The clerk on duty was new and said we were too late, there were no trucks on duty before nine in the morning. I asked nonchalantly what field this was. He as unconcerned replied, "Danville, Illinois." I was shocked. I had never heard of Danville and to be in Illinois was an embarrassing thing to explain. Where were we headed? Fort Knox, my buddy replied. I hastily asked where gas could be obtained and he said, "Southeast to Terre Haute."

I grabbed Jim and we rushed out; I knew what the next question would be—where had we started from? I was not prepared with a (*Continued on page* 76)

What's New
IN SMALL AIRCRAFT
FUEL INJECTION

Because it measures mass-air-flow rather than engine speed, the new Bendix RS Fuel Injection System offers many advantages for light aircraft engines • The system automatically maintains constant fuel/air ratios and load compensation over the complete power range under all operating conditions • Engine speeds may be adjusted at any time without affecting the rest of the power curve • The Bendix RS Fuel Injection System offers design flexibility to give ideal power/economy performance.



For improved performance . . .

CHECK THESE FEATURES

- Unitized package—no engine speed drive pad.
- Fewer moving parts, lower overhaul costs.
- Uniform fuel distribution to all cylinders.
- Longer engine life—no hot cylinder heads.
- No throttle body ice, no vapor locks.
- Leaner engine operation, greater fuel economy.

Will your new aircraft have the Bendix RS Fuel Injection System?

Bendix PRODUCTS DIVISION South Bend, IND.

THE Bendix CORPORATION

Riviera

(Continued from page 34)

the Comanche or the Debonair.

In my opinion the Riviera is a fast, comfortable airplane with a high utilization factor because of its amphibious qualities. It is easy to fly and is tailored to the capabilities of landplane pilots. As a seaplane, it has certain limitations imposed by its small size and light weight. Nevertheless, its ruggedness and excellent corrosion protection make it suitable not only for lake operations but for flying off salt water too.

The Rivieras marketed in this country will be shipped from Milan, Italy to Dallas, Tex. minus engines, propellers and instruments. Southwest Airmotive in Dallas will assemble the airframes, mount the powerplants, which will be Continental I0470Ps rated at 250 hp, and install the instrumentation for Lane Aircraft.

The models sold in the United States will differ slightly, constructionwise, from the European counterpart in that the metal skin will be of heavier gauge; and all nuts, bolts and fasteners will be of U.S. standard. The aircraft is FAA Type Certificated in normal category. Price of the Riviera will be $34,950 f.a.f. Dallas. Standard equipment will include dual controls and full instrumentation.

SIAI-MARCHETTI RIVIERA

Specifications:

Wingspan	34 ft.
Overall length	24 ft. 3 in.
Height (at rudder)	10 ft.
Wing area	163 sq. ft.

Weights:

Weight empty	2,137 lbs.
Gross weight	3,270 lbs.
Useful load	1,133 lbs.
Baggage capacity	330 lbs.

Fuel and oil capacity:

Fuel capacity (standard)	37 gals.
With auxiliary tanks	65 gals.
Oil capacity	4 gals.

Performance:

Maximum cruising speed 75% power (187 hp at 2,300 rpm, 164 mph at 5,000 ft.)	
65% power (162 mph at 2,300 rpm, 159 mph at 9,000 ft.)	
Maximum speed at sea level	177 mph
Initial Rate of climb at sea level	1,280 ft./sec.
Takeoff run (land)	925 ft.
Takeoff run (water)	1,480 ft.
Range at economical cruise at 8,000 ft. with 65 gallons of fuel	1,025 miles
Service ceiling	19,000 feet

As soon as the first aircraft is assembled, it will be flown on a 45-day demonstration tour during which its sales potential in North and Latin America will be sampled.

According to Gerald L. Spear, Lane Aircraft's executive vice president, there has been considerable interest in the amphibian with inquiries coming from all over the United States, Canada, Puerto Rico and South America. Sales territories, at present writing, have not been assigned. END

THE THRUST LEVER

By CAPTAIN DAVE KUHN

THERE ARE MANY problems connected with operating a safe airline. Some of them are self induced. Most carriers insist on serving alcohol to the customers despite the serious threat to safety drunks aloft pose.

The captain in command is charged under the law not to carry persons under the influence of drugs, liquor or narcotics. Yet, there is not a plush flight flown by the large U. S. carriers today, but that some of the passengers get "boiled" by the time they reach destination. Why this treatment is necessary has never been explained.

Now, pilots have been known to gaze at the grape on occasions. However, they have long protested the added chore of wet-nursing inebriated passengers. It is a nuisance at best. It takes only one drunk on a flight to create enough havoc to jeopardize safety. Aside from the social aspects, such as cursing, vomiting or responding to Cupid, a drunken crazed inebriate can wreck a plane.

Then, of course, there is no way to determine which passenger will get out of hand after imbibing. On one occasion, a movie mogul was caught trying to bash a window out with his shoe. He was too warm and couldn't raise the sash. Had he been successful, he would have left like a shot from an air gun. There also would have been more serious problems, such as getting down to a breathing altitude in time to save the flight.

One wild-eyed passenger broke into the cockpit and started pummeling the captain on the head. The flight was a bit late and the drunk was urging more speed. He was tied up, with a ditching rope, for the remainder of the flight.

Drinkers are careless with cigarettes and matches. There are not many situations more dreaded than fire aloft. This writer had one such incident caused by careless drinkers. The hostess came up front in tears. A group of six men returning from a sales convention were in the lounge section insisting on being bartenders. The hostesses, being outnumbered, had lost a battle. A first look revealed a group of salesmen in a singing, drinking, storytelling mood. A second look revealed smoke pouring from under a seat. A live cigarette had been dropped between the rugs. Rugs on airplanes are fire-resistant to some extent. However, grease from the ramp, hydraulic oil, and whisky can make a start on a good fire, especially when a live cigarette is used as an ignitor.

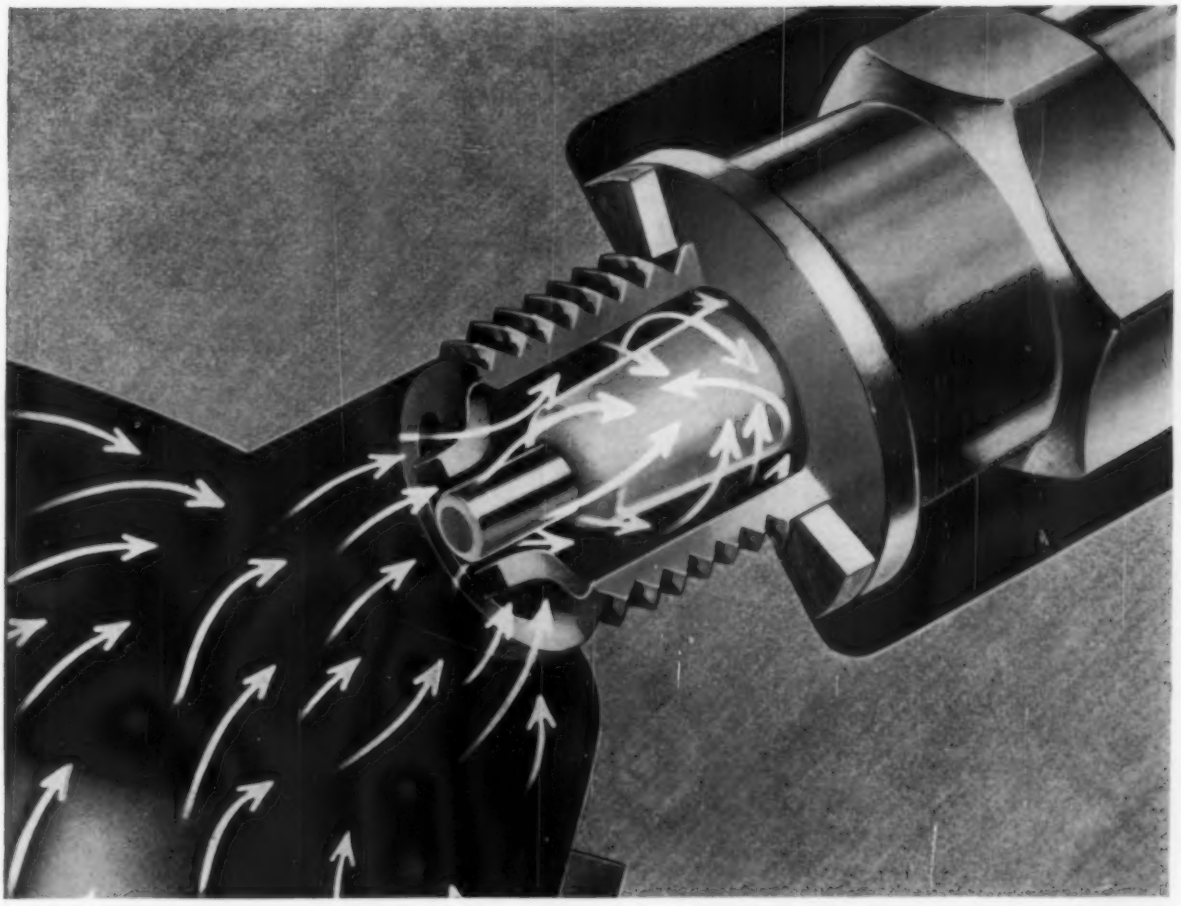
The ALPA and their sister Union, ALSSA (pilots and hostesses), have kept records of drinking incidents. They are rather impressive to those taking the time to read them. The worst cases develop from individuals who have had a few belts prior to boarding. Altitude gives an added lift from the booze already consumed and currently in hand. Instead of reading a magazine, sleeping or enjoying the "captain's comments," our glassy-eyed subject is up and down the narrow aisle with a drink in one hand, making friends.

Being irresistible (he thinks), he gets miffed when he is requested to sit so that others might be served. If he does not get all the drinks he thinks he needs, everyone in the plane is informed that the president of the airline will hear of this outrage. He advises that he is gonna get someone's job. (It is doubtful if he would like the pay of a hostess.)

On rare occasions, the passenger agent will request that you take a look at a suspected inebriate prior to boarding. Without looking you know from past experience, that the suspect is either stumbling, incoherent, or abusive. You take a look anyway. It is impossible to inspect 120 people for sobriety before departure. Besides, some folks look drunk in their natural state. Many flights have been forced to land and deplane drunks. Lawsuits result. The companies have trapped themselves. It costs millions each year to give free liquor to customers that may destroy a flight or cause additional expense. Unscheduled landings mean late arrivals which means late originations or cancellations. The Canadian airlines carry passengers and do not feel obligated to pour free drinks. It seems that a fast, smooth, safe trip would suffice. Bars are not competing with airplanes.

Despite several pages in the company manuals on how to cope with drunk passengers, the instructions never seem to fit the conditions. Bars have husky bouncers. On an airplane, a 110-pound hostess has no place to bounce a 210-pound "cassanova." The final word is to "advise the captain."

In 1954 the Airline Pilots Assn. adopted a policy prohibiting drinking aloft. Unfortunately, they have been less successful implementing this policy than the "fail safe concept." Congress has before it two bills outlawing drinking aloft. ALPA was instrumental in getting these bills on the agenda. It is hoped Congress will act.



Notice how larger bore opening allows full blast of combustion gases to cleanse the longer core nose for greater protection against fouling-deposit build-up.

Get full-firing performance—longer . . . with new foul-resistant Champion Spark Plugs

New firing end design prevents fouling build-up even under long periods of idle . . . virtually eliminates burn-out . . . and doubles, even triples, spark plug life!

When you operate your aircraft under conditions that require frequent long waits at idle, full power at take-off, and smooth cruise power for extended periods, you can rely on Champion's new foul-resistant spark plugs for full-firing performance—longer.

The remarkable fouling resistance of these new spark plugs stems from a completely redesigned firing end. A new two-prong electrode (instead of four-prong), bigger bore and longer core nose "open up" the business end of the new plugs to the full blast of combustion gases for continuous self-cleaning action.

A world record flight dramatically demonstrated the performance of these new plugs. Max Conrad, shattering records with a 3-day, 7,668-mile, single-engine flight, reported: "Champion's new foul-resistant plugs made such a flight possible!"

So to get full-firing performance from *your* aircraft, get these new foul-resistant Champions today. Approved for all popular aircraft, they are available in REM40E and REM38E for short reach ⅝ 24 applications, as well as All-Weather RHM40E and RHM38E. RHB37E, RHB32E and RHB29E are available for long reach ¾ 20 installations.

CHAMPION

SPARK PLUGS

CHAMPION SPARK PLUG COMPANY

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fly for as little as $4 per hour

Slickest plane for flying clubs... the Piper Colt. Slickest plan for low cost club flying... the Piper Colt Club plan.

With 10 members it's only $100 per share to start with; less than $3 per week per member. With 20 members it's only $50 initiation fee and less than $6 per month per member to own a sleek, brand new maintenance-easy, safe-as-can-be Piper Colt. Actual flying costs are less than $4 per hour!

And the Colt's the best all-around plane for club use you can imagine. Ideal for initial instruction and solo—safe, simple, docile in the air; trouble-free on the ground thanks to tricycle landing gear, with large-size nose wheel. The Colt's ideal for cross-country, too; 115 mph cruise and a fantastic payload—enough allowance *and room* for all the baggage two people could ever need.

Why not get together with other air-minded friends and form a Piper Colt Club? For full information on costs, plus suggestions and hints on organizing a Colt Club just send in the coupon below.

PIPER AIRCRAFT CORPORATION
Lock Haven, Pa.

Please send me full information on the Piper Colt and the Colt Club plan.

Name_____

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G-4

MORE PEOPLE HAVE BOUGHT PIPERS THAN ANY OTHER PLANE IN THE WORLD

Vertigo

(Continued from page 43)

fear and worry, excessive needless head movements, and long intervals away from flying.

In military flying, day weather formation flying is the most common cause, especially for the wingman. Head movements during a procedural turn under instrument conditions have been directly responsible for disorientation that resulted in a series of fatal crashes.

The time lag required in shifting from VFR to IFR (20 to 40 seconds) may be enough to allow disorientation of the pilot, or to permit the aircraft to enter a dangerous attitude without the pilot's awareness. The same can occur during map reading, locating a radio channel, searching for a radio facility chart, computing the fuel supply, writing down ATC clearances—whenever the outside visual reference (earth, horizon, stars) is temporarily ignored. The problem is most serious in jet aircraft; in carefully supervised tests, when outside visual references were cut off from the jet pilot, within 45 to 65 seconds on the average the aircraft entered a dangerous attitude from which it could not be recovered during a 10,000-foot descent; usually the aircraft entered a climbing turn but ended in a diving spiral, *without the pilot's awareness of any change of position or direction.*

Nearly all experienced pilots have had one or more episodes of vertigo, of which over 75 per cent are minor and harmless, lasting from a few seconds up to the entire duration of a flight. Five per cent of them, however, are severe enough to cause loss of control of the aircraft.

Pilot's vertigo can be avoided by:

1) understanding the nature and causes of the condition.

2) avoiding as much as possible the factors listed above which tend to bring it on.

3) adequate instrument instruction and continued practice.

4) having faith in your instruments rather than in your sense-organs of equilibrium.

5) remembering the words of other pilots. "I had the sensation of being on my back, though I had enough reference to realize that I was in a mild bank; I could not get rid of the sensation." "I was flying along in a marked skid, though I thought I was straight and level." "I could swear I was straight and level, even though I saw the altimeter spinning down and the speed building up."

The body has an elaborate system for detecting motion, but it is not infallible.

The organs of equilibrium in each inner ear consist of three tiny hollow tubes, bent to form semi-circles. They are lined by fine hairs, and filled with liquid. Each of these canals is set at right angles to the other two. When the body is moved or rotated in the plane of a canal, a current is set up in the fluid in that canal, deflecting the tiny hairs along the inner wall and giving rise to a sensation of movement.

One end of each canal opens into a small chamber or saccule, where calcium carbonate crystals rest upon fine hairs which are bent by any tilting of the head, thus reporting the position of the head with respect to the earth. These organs give accurate reports under normal circumstances, where movements are relatively slow, where turns are usually 90 degrees or less, where accelerations and gravitational forces are average, and where the supporting surface, i.e., the earth, is stable. Yet there are certain limitations.

Under normal circumstances, a blindfolded man can be tilted slowly 24 degrees upward or 10 degrees downward without his awareness of any change in his position; the tiny hairs in the saccule do not report the change to him. Experienced pilots are often more sensitive, though still not able to detect changes of seven degrees upward and four degrees downward.

If the same blindfolded man is spun very slowly in a revolving chair, at a rate less than two degrees of rotation per second, no current is set up in the fluid in the semicircular canals, and the subject is not aware of the turning at all. If he is then spun rapidly, the hairs in the canals are deflected by the current in the fluid, and the subject can report his movement correctly at first; but as the fluid "catches up" with the turning movement, the hairs return to their resting position, and the subject then feels that he has stopped moving. If the actual rotation is then slowed a trifle, the fluid continues its more rapid movement, the hairs are deflected in the opposite direction, and the subject feels that he has reversed his direction of rotation.

In addition, at the end of a prolonged turning, the equilibrium organs do not recover immediately to normal, but may continue to report a turning movement, first in the same direction, then in the opposite direction. If two semicircular canals at right angles to each other are stimulated at the same time, as by abrupt movement of the head during a continued rotation of the body, severe confusion can result, with complete loss of spatial orientation. END

Maintenance

(Continued from page 37)

fabricated fuel line. Not much, but any other maintenance you perform will make you an outlaw.

Though some will say that the FAA has its shortcomings, its basic motives are beyond question; it seeks to make flying through the air as safe as sitting in an easy chair. And it deserves respect, for it has the authority to take action against any pilot or mechanic who is not, in its opinion, operating safely.

One pilot with a good knowledge of engines performed a major overhaul on his own airplane's engine. In the process, he installed bearings of a type that were not approved for his engine, and an FAA inspector talked to him. "You should have your work approved by a certificated A&P mechanic," the FAA man said. "No matter how much you know about engines, the civil air regulations don't recognize your work as legally done without his supervision and his signature in your log."

The next day the inspector noticed the

(Continued on page 62)

Airplane is Aero Commander 500-A, now equipped with the Exide AC-78 integrally manifold vented battery as original equipment.

Exide AC-78 Gives You Most Power per Pound and Is Interchangeable with Less Powerful Batteries

A more powerful battery means extra safety for you in the air. Suppose your generator cuts out. With an AC-78, you have the extra power you need to keep your instruments and radio operating to help you down to a safe landing. Yet you don't carry needless weight. The secret is in the battery's construction. New, more powerful plate materials pack more power per ounce. Its lightweight high-impact polystyrene container is actually stronger than hard rubber.

Holds its charge. Patented plate processing gives Exide batteries the ability to hold their charge . . . even if your plane is idle for weeks. No delays in taking off. Low upkeep costs. Long battery life means greater battery economy.

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SEE THE NEW EXIDE BATTERIES NOW . . . AT YOUR DEALER'S

AC-34
45 amp/20 min.
24 amp-hr./5 hr.
21 lb.

AC-66
60 amp/20 min.
33 amp-hr./5 hr.
26 lb.

AC-78
66 amp/20 min.
35 amp hr./5 hr.
27 lb.

(Continued from page 60)

airplane in the air. A violation was filed against the pilot, who suffered the loss of his pilot's certificate for the next twelve months.

The FAA conducts surveillance checks of light aircraft and checks aircraft logbooks for proper signatures when maintenance work does not look professionally finished. When an inspector discovers illegal maintenance performed, the airplane owner is subject to violation and can draw a penalty as stiff as a $1,000 fine and the permanent loss of his license.

The pilot-owner is not the only man in trouble when the FAA discovers air safety violations. A multiengine passenger airplane had just had its flight controls rerigged. The A&P who performed the job signed his work as complete, a company inspector checked it and added his signature to the log. When the FAA maintenance inspector checked the job, he noticed that the quality of the work was good, that the turnbuckles were safety-wired at the proper tension, that the control cables were in perfect condition. There was only one difficulty. As he turned the control wheel to the left, the left aileron deflected down, the right one up; the pilot who next flew that airplane would have been puzzled for a second as he turned the wheel to the left and the airplane banked to the right. The company inspector lost his license, the A&P was fined. Whether you're a pilot or a mechanic, it is best to double check your work before the FAA inspector arrives.

As an aid to the proper performance of aircraft maintenance, the FAA publishes Civil Aeronautics Manual 18, a 226-page book filled with techniques and procedures for maintenance and repair of light aircraft. Available from the Government Printing Office in Washington, D. C. at $1.50, this manual is the single most important publication for anyone who opens a toolbox on an airport. Still, though a pilot may be able to recite CAM 18 by heart, backwards, he must have that A&P's supervision and signature in his log when he finishes work on his airplane.

IT IS possible an A&P can be your worst enemy; that his signature can be bought. It has happened that a mechanic glanced at the engine to see that it was still there, signed the log, and accepted his fee. As long as you are going to pay for it, make sure that your A&P really does supervise and inspect your work; a paid-up signature in the log doesn't mean much when the engine slows to a windmill after takeoff or one landing gear dangles in the breeze after a touch-and-go.

If you want to perform an operation of maintenance that is not covered in CAM 18 or want to use different procedures than it requires, call on the maintenance inspector at the FAA general aviation district office. He is interested in seeing that the work is accomplished at an equivalent level of safety with the standards held in the manual.

Check your airplane well before you fly, and particularly well as flight hours advance from its last periodic inspection. With a wooden propeller, watch for rotting of the wood that will allow the hub bolts to loosen in their holes, check that the rivets holding the metal plate on the leading edge of the blade are tight, check that the fabric at the tip is still firmly in place. Trouble here calls for A&P-approved work, for even the fitting of a new prop requires his signature.

On the other hand, if you notice cracks developing in your airplane's windshield or metal skin, you can stop-drill them without any signing to be done. Stop-drilling is considered to be preventive maintenance.

Similarly, when you find the need for any simple repairs to fairings, cover plates, or the cowling, you can accomplish them yourself if they won't cause a change to the part's contour or the airflow over it. If the shock struts of your retractable landing gear are low, you can legally service them with oil or air to bring them back to their proper extension; once again, you are performing preventive maintenance.

If you are in doubt whether a bit of work would be considered preventive maintenance, check your CAM 18 or call the nearest FAA office for the answer. Safety is the key. If you look at the work to be done on your airplane and ask yourself by whom it would be most safely accomplished, you need never have a cross word with the Federal Aviation Agency.

Cultivate your A&P. With him as your friend you will not only learn more about the operation and maintenance of your airplane, you will come as close as you can to being the pilot-mechanic-designer-engineer-manufacturer that flew through the skies of the good old days. END

Jules Manger, Jr., Chairman of the Board, Manger Hotels, is seen with his wife and two of their seven children, all ardent flying enthusiasts.

"I find that flying my own plane is a big time-saver in business and allows me more time at home with my family. It's often necessary for me to make quick trips to our hotels, and the easiest, fastest way is to fly myself.
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Army Aviation

(Continued from page 42)

simplifying helicopter control by using jet flap rotors—blades propelled by sheets of high pressure air ejecting from the trailing edge. Pneumatic valves are proposed for change of airstream and to equalize blade loads. Army's TRECOM European office has worked out plans to test the system in NASA's Ames Laboratory.

The Hughes hot cycle system is about ready for whirl tests. Army researchers express a great deal of interest in the plan to pipe hot gases through hollow blades for ejection and forward thrust at the tips. However, many problems having to do with design, production, pressure sealing, etc., must be researched through test. Should such a system be economically practical, mechanical transmissions could be reduced or eliminated, blade loads can be equalized and torque minimized.

Sikorsky is carrying on a one-million-dollar research program, of which 15 per cent is Army financed, in an effort to define a 225-knot helicopter. Much of the research involves ways and means of handling rotor problems at this high speed. Experts seem to agree that helicopters, as we know them today, will be limited to speeds under 250 knots as a result of rotor blade aerodynamic restrictions.

Among the important new concepts involving combat forces of Army aviation is the Aerial Reconnaissance and Security Troop (ARS Troop), better known to the public as the air cavalry.

ARS units are not to be confused with the abortive Sky Cavalry which was ruled out because it provided no organic firepower.

The first air cavalry unit is in test stage at Fort Stewart, Georgia. It is a combined force of 27 aircraft, 35 officer and warrant officer aviators and 115 enlisted personnel. The troop uses 16 reconnaissance helicopters and 11 utility transport aircraft. The latter carries a rifle platoon, a weapons platoon, maintenance men and support units. All helicopters except one, for medical evacuation, are armed with fixed mounted machine guns. Four transport rotorcraft carry 4.5-inch rockets and machinegun kits. The rest are unarmed, but as the HU-1B is phased in, all are expected to carry some kind of suppressive fire weapons.

As mentioned previously, one ARS Troop and an additional aviation unit composed of 40 aircraft will be assigned to each of 14 army divisions. Commanders will no longer draw basic air support force from remotely located pools. Division aircraft will operate in the first few hundred feet of air space above the battle area, and be expert in snake-like flight along valley, stream, hills and woods to avoid exposure to enemy target-seeking missiles and small arms fire. Their mission is strictly that of scouting and reconnaissance—not fighting.

Total aircraft availability to the division under present plans is 300, compared to 25 field-type craft during WW II.

The revolutionary trend toward ground-hugging, high speed flight poses some sticky problems on the aircrew side of the

(Continued on page 66)

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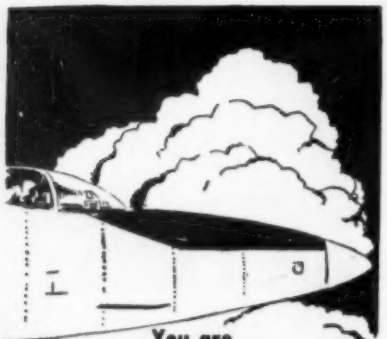

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(Continued from page 64)

ledger before the newer, advanced weapons programmed can be used efficiently. Hills, valleys, turbulent air, human reaction limitations, stresses upon aircraft and equipment spell out the need for painstaking research in flight techniques and human survival.

Sustained flight in combat at low altitude, under constant tension and extreme physical discomfort, alone make fatigue a number one target for science and engineering.

The Army has taken aggressive action in this direction and is receiving strong support from both the Air Force and the Navy. The Grumman Mohawk is the first of its air weapons to reach into the 250 to 300 knot speed bracket. Already treetop flights at these speeds, with attendant interference from terrain an obstacle clearance maneuvers present serious distraction from the prime military mission. Concentration upon radar scopes and infra-red search systems is impaired. Escape via the Martin-Baker ejection seat in any position other than an upright, level flight posture threatens aircrew survival. As flight speeds are increased the condition will be compounded many times over.

In connection with its human factors program, Army aviation made history in January by adding the Fiat G-91 lightweight NATO jet fighter to its low-level, high-speed flight evaluation project. This miniature Mach 1 fighter (first to wear Army markings) will also be used for study of jets in rough-field based treetop tactical support on the division level. Army pilots have been flying the 4,300-pound G-91 in European tests alongside pilots from Turkey, Greece and Germany.

Much of the Army's work is being coordinated and carried on at the Aviation Test Center, at Fort Rucker. Aircraft and human factor programs are directed by a Combined Test Activity, including Army Aviation Aircraft Board, Transportation, Signal Corps and Human Research (HUMRO) research test groups. Various phases of the investigations are "farmed out" to civilian laboratories or they are coordinated with other branches of the military and NASA.

TRECOM's Col. John Crowley said, "Methods for conducting the human factors research are seemingly as complex and difficult as the tests themselves."

In addition to the research work, Rucker is headquarters for Army aircrew and ground support personnel training. The school, under the command of Maj. Gen. Ernest F. Easterbrook, processes about 1,000 aviators and 4,000 enlisted men annually. Now, with the introduction of electronic and infra-red target search and identification systems, training of copilot-observers is sure to receive ever-increasing emphasis.

Paralleling Army aviation's progressive push ahead as a modern airborne fighting force is the R & D work being done with missiles and drones. Although research direction and responsibility is under the domain of the Signal and Missile branches, Army aviation plays an important cooperative role in development operations. Detailed mission capability is spelled out for the manned and unmanned phases but there is one dominant fact of life—none of the robots is able to perform without human guidance and interpretation. Airmen are confident that drones will be used only where man cannot go, when the mission warrants the expensive one-way trip.

The 1970 goal is a big order of the highest magnitude. It is not known what the nine men of the Rogers Board have to say about other aspects of the growth plan, but it's evident from talks at the Pentagon and at other headquarters commands that Army management has much to do before the 1970 target is reached. The principal ones are these:

- Number One Mission is that of funding. End of decade cash needs are for $250 million yearly compared with $130 million for fiscal 1961.
- Command indoctrination in the "feel" and use of AA service has made great strides since the Korean War. Scores of general officers and field commanders holding rank of colonel now wear wings and have completed flight training. But the program needs to be expanded to include orientation to non-flying personnel, instead of curtailed, as it is now due to shortage of funds. It's 40 per cent of what it should be.
- Closer management attention must be devoted to integration of Army air into field commands to avoid separate "air force" or "privileged class" attitude toward aviators by non-flying personnel, and to insure maximum effectiveness of ground-air specialties. Army Aviation's philosophy expressed to this reporter is that every aviator has a ground job in the command and the division. In short, there is a desire to put the Army's "own sprawling operations together" to obtain tighter, more effective programming.
- The whole expansion program can be blocked if Congress and the Department of Defense do not remove the present restriction upon aviator strength. There are 99,000 officer pilots in the armed forces; DOD has set the Army's ceiling at 7,000. If the limitation continues beyond July 1st,

Army pilot with ejection seat leg retainers.

(Continued on page 68)

WING TIPS

WHEN LOST IN FLIGHT —EMERGENCY PROCEDURE

If you're ever lost, here's what to do: WITH RADIO CONTACT: Tune to emergency frequency 121.5 mc. Fly a triangular pattern to the right in 2 minute legs with 1½° per second turns of 120°. Complete a minimum of two patterns before resuming course. If radar contact is established, instructions will be given on 121.5 mc. NO RADIO CONTACT: Fly a triangular pattern to the left in the manner described above. If radar contact is established, a Search & Rescue plane will be dispatched for interception. Resumption of course will not compromise this system as your plane will continue to be tracked as "distressed" from the point of initial radar contact. If possible, repeat the procedure each 20 minutes until instructions are received or interception by Air Rescue Service is accomplished.

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(Continued from page 66)

pilot strength will drop instead of grow to meet the real requirement.

- The DOD-directed USAF-Army agreement that the USAF would serve as the aircraft procurement agency for all army aircraft within the empty weight class of 5,000 pounds for fixed wing aircraft and 20,000 pounds for helicopters needs to be reviewed. Specialized requirements of the Army aviation argue well for its doing its own shopping.
- Roles and missions as related to the Army and USAF close support of battlefield operations must be re-examined. The current USAF trend in supersonic, high altitude aircraft—called "junior SAC bombers"—impairs its ability to provide close battle area support against front-line targets. Army men naturally think they should now be able to protect their own because the Army-USAF prime air combat missions have become so widely divergent.
- It appears reasonable that the USAF should continue to carry out heavy firepower interdiction and high priority close support on a frontwide basis, and that Army should have its own lightweight, subsónic, forward based fighters to provide treetop cover for division air mobility operations. This is one reason for AA's evaluation of the Fiat G-91.
- Present policy as embodied in Rogers Aircraft Review Board should be updated annually to include changes in tactics and scientific engineering advancements, without hampering the long range value of the program.
- An old story to USAF is being heard again: "We must wage a relentless fight against black-boxing ourselves out of action" cry commanders who want industry's help in moving field operating reliability of aircraft nearer to that of the truck and jeep, and still provide greater assistance to aircrews in finding targets and carrying out variety of missions. Fiscal '60's R & D budget is $36,000,000; it should be $70,000,000 by 1970.
- Army aviation needs its own capability to conduct tests and evaluate its specialized equipment, to insure conformance to critical field-operations requirements. Ten Army aviators are now attending USAF flight test engineering school at Edwards AFB. General feeling is that more pilots and electronic specialists should be placed in the same pipeline.
- Despite the importance of the Tri-Service STOL project to Army's special needs, some observers fear the program may tend to delay progress on vertical rising craft research. They believe $10 to $12 million —"peanuts"—is adequate to push ahead in the small flying platform and one-man rotor craft projects, thus accelerating infield environmental testing on an acceptable economic base. It is reasoned, "We didn't start building airplanes at the DC-3 and DC-6 level." Why should we reverse the order in STOL?

Despite an individual's special interests —whether he or she be partial to the Army, Navy or Air Force—the casual observer of the Army aviation prospectus cannot help but feel better that air mobility for ground forces is getting serious attention. How far Army aviation is able to grow depends in a large measure upon public, Congressional and Department of Defense recognition of its practical, realistic place in our future.

AA has pioneered fields of flight overlooked during the last decade in the rush to reach the moon. Its down-to-earth emphasis upon the simple problem of lifting men and materiel over the trees, hills and valleys has been instrumental in keeping our overall perspective.

TO the men and women in civil aviation, the AA goals are generous in promise of benefits to those of us who fly for business, pleasure or necessity. Accumulative advancements of flight are just not limited to faster, simpler and more reliable airplanes and helicopters: Army Aviation has helped develop Lycoming, Allison and GE free shaft turbine and turbo-prop engines, better and less expensive radios and instruments such as the Sperry Universal autopilot, new techniques for safer flight such as helicopter IFR procedures, and a multitude of other advancements which help push civilian aviation closer to a brighter future. Its work in infra-red and radar should, in another decade, pioneer important dividends for the civilian pilot in the form of low-cost terrain clearance and collision avoidance systems.

It seems, after more than a decade of stargazing, that our final destiny can depend in a large measure upon our single most potent weapon—men who can outthink and out-perform the missiles. END

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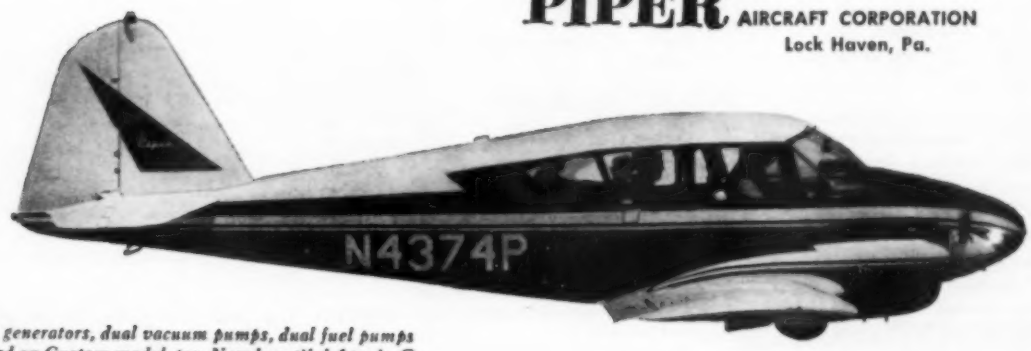

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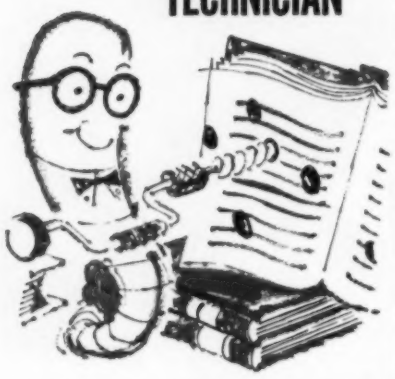

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Sperry

(Continued from page 47)

lowing the putting together of North American, Morgan must have felt like the sparrow that got caught in the badminton game. First he was president of Sperry Gyro, then of B/J, then of Eastern Air Transport (which had been Pitcairn), then V.P. of Ford Instrument Company, then President of the whole ball of wax, North American itself, and finally in 1931 President of Curtiss-Wright. During this period Sperry Gyro readjusted to put fresh emphasis on aviation products, pursuing its steady formula of research, development and production—in that order.

In 1933, General Motors took over the C. M. Keys interests. Now the Sperry Corporation was formed and cut loose from North American, with Morgan as President. Sperry Corporation as realligned, included Sperry Gyro and Ford Instrument to which were soon thereafter added Waterbury Tool (1935) and Vickers, Inc. (1937). Each company retained its identity and freedom of initiative although overall policy direction came from Sperry Corp.

The pattern of defense partnership with government and extension of appropriate equipment into the civil market continued to be Corporation policy as it had been that of Sperry Gyro. Morgan was high on aviation—had tried to maintain Dr. Sperry's interest in it after Lawrence's death—and now Sperry Gyro concentrated in that area. Vickers was a coming leader in hydraulics—pumps, transmissions, etc.—and most of that business was civil. Ford Instrument and Waterbury were locked in as chief suppliers to Navy.

As the mid-thirties passed, most realists saw that international issues would almost certainly not yield to the arts of diplomacy. Sperry Gyro began to plan for the burden of servo mechanisms which would be expected of it. A sub-contracting system was worked out—Chrysler to produce gyro compasses; General Motors, gyro-horizons; Ford, antiaircraft directors; A.C. Sparkplug and Eversharp Pencil, automatic pilots; National Cash Register, computing gunsights—these as examples of 22 such sub-contracts. The work force quadrupled by 1939. The two million square-foot Lake Success plant was in operation by 1942, additional to nine other plants in Brooklyn. The employee roster rose to 32,000.

Sperry Gyroscope, had never been exclusively devoted to the aircraft industry. In no year of the company's first two decades of operation has a major share of its income originated in the aviation market, despite that its airwise partnerships with both Army and Navy were continuous. Aviation just wasn't the primary defense market in those days.

Nevertheless, Sperry's sponsorship of flight and navigation control was and is of such significance that the story of airpower could not be recorded apart from the company's contributions. Nor is this even to consider such supplemental developments as the bombsight, the radar ranging gun sight, the high intensity searchlight, the all-weather approach system and numerous other aviation tools.

Perhaps evaluation of Sperry Gyroscope as one of the Giants of Air Age Industry could be pointed up no better than by a simple listing of some major "firsts."

In 1910 the first stabilizing gyro was installed in an aircraft. By 1912, Lawrence Sperry was flying a Curtiss boat with an autopilot—the origin of a long evolution of servo mechanisms which today equip supersonic jets and space ranging missiles—even blimps and helicopters, vehicles in the low range of the speed spectrum.

In 1915, Sperry approached government with the concept of a guided missile. Before the end of WW I prototype missiles were scoring accurate hits up to 50 miles! Award of the John Fritz Gold Medal to Sperry Gyroscope in 1927 publicly acknowledged this achievement although such was the secrecy that the original patents were not disclosed until recently. The reader may ponder how such a weapon lay dormant in our arsenal and eventually was perfected by our enemies rather than ourselves. We can only reflect that liberty must continuously – not spasmodically – be defended – that peace is axiomatically the responsibility of the peaceful.

The first gyro-stabilized bombsight by Sperry, in 1916 originated developments which led to the automatic combined bomb and navigation systems used by strategic airpower, and to inertial guidance systems which furnish precision controls to missiles, nuclear submarines, space vehicles and such manned aircraft as the multiple-mach bombers—B-58, B-70, and ?.

In 1916 also, Sperry received the Collier Trophy for the draft sight, one of the family of instruments which included such others as the aircraft compass, altimeter,

Sperry S-1 Bombsight

airspeed indicator and bank indicator.

By 1929 Sperry had so automated flight control that by virtue of the supplementing Directional Gyro and Gyro-Horizon, Jimmie Doolittle could fly "blind" from takeoff to landing. This was a long step toward air commerce and military airpower. Now came radio guided navigation. By 1935 Sperry had the Radio Compass linked to the Automatic Pilot.

During (1938-'39) Sperry participated in two major advancements—the Radio Automatic Direction Finder and the Klystron tube, a break through to microwave radar.

During WW II, manually pointed anti-aircraft fire was replaced by remote controlled automatic aiming. Expenditure of ammunition per enemy aircraft shot down dropped radically. Sperry could add an-

(Continued on page 72)

Heading up the operation at Four Corners—(*left*) Jack Roberts, President, and (*right*) Tom Buress, Sec.-Treasurer.

Rocky Mountain Haven at Four Corners

Four Corners Aviation, Inc., at Municipal Airport, Farmington, New Mexico. Flight office and lounge are on the right.

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(Continued from page 70)

other "first" to its long list of credits.

The year of 1944 saw Sperry on the job with a new tool for long-range navigation—the Gyrosyn Compass, a true directional gyro slaved to earth's magnetic fields with a flux value restoring reliable magnetic headings.

To greet post-war air commerce, Sperry was ready with the first Automatic Approach Control System which worked through the Automatic Pilot to assure precision instrument approaches to airport runways. This was followed shortly by Remote Control Command Guidance. Unmanned high performance jets or drones could be taken off, maneuvered through "G" loads beyond human endurance and landed precisely by either ground based or airborne controllers. Simultaneously Sperry developed an automatic pilot for helicopters and another for Blimps.

Next came a development of exceptional significance—the Automatic Radar Ranging Gunsight. The Soviet had developed the MIG fighter series in quality and quantity to take over the skies of the world, manufactured to the number of some 13,500. The MIGs caught the free world with its fighter hardware down. Korea was the test area. Air supremacy achieved there could have triggered a war of world conquest by the Kremlin. However, as combat progressed, the Red fighters were outshot in ever higher ratio. By end of the "police action" the score in kills stood 13 to one against the MIGs. The deadly accuracy of the radar gunsight was a big factor. Not least of the interesting circumstances involved was that the sight when first introduced was scarcely beyond the prototype stage nor had the fighter pilots had any previous indoctrination with such a contraption.

In 1954 Sperry authorized the first air-to-air guided missile to be operational in the Navy, the Sparrow I.

In 1957 came an Inertial Navigation System which among other functions served to establish launching data for ballistic missiles, notably Polaris. In that same year came Multi-Beam Missile Super-Radar Guidance systems for other missile programs such as Terrier and Talus, to be followed shortly by an inertial system for controlling the X-15's re-entry into earth's atmosphere when that manned research craft reaches such a requirement.

Added to the list of recent developments too should be mentioned a long-range, altitude-probing radar for use in tactical defense against enemy penetration.

None of this listing mentions such marine and seapower developments as the Gyrofin Stabilizer, the Mark 14 Naval gunsight, the Naval Radio Control Gyropilot, the inertial navigation systems which enable the submarines to thread northwest passage under the ice, or other non-aviation uses.

But enough strictly "aviation firsts" are of record to establish Sperry firmly as an Industrial Giant of the Air Age.

In our final article on Sperry we will sketch the industrial complex that is Sperry-Rand—a complex so vast that it reaches into almost every phase of industrial life in the free world.

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ON COURSE, ON THE GLIDE PATH: This specially prepared album is so real—so true that you know you're in the pilot's seat as you come in for a ground controlled radar approach at the Los Angeles International Airport. This recording details to you the proper use of ground, tower and approach controls. You learn to use, as well as hear, all the radio aids to navigation. Included with each album is an illustrated, detailed brochure which explains marker beacons, omniranges, L.F. ranges, fan markers, compass locators, ILS components and all radio navigational aids. A 33⅓ rpm, Hi-Fi, L.P., pure vinyl album.

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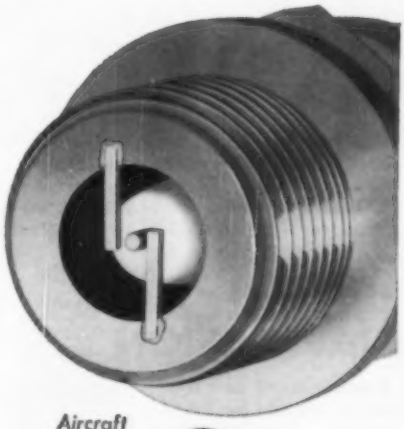

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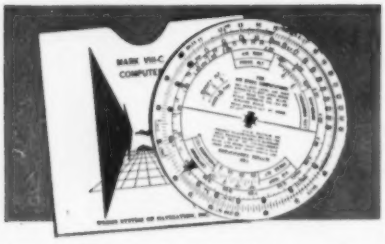

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Coronado

(Continued from page 45)

already moving towards Coronado. A short distance away is the new American Gypsum plant and a new Public Service Company of New Mexico power plant. In a matter of minutes one can reach the new Kaiser Gypsum plant at Rosario. Also the FAA's new air traffic control center for Albuquerque is just south of Coronado.

During the heaviest traffic periods, downtown Albuquerque is only a 20-minute drive from Coronado. And it is 10 minutes to the city's mushrooming Heights section at the east end of the community.

Throughout the southwest, Coronado is gaining a reputation as the airport with the Tiffany touch. This is a tribute to the excellent facilities, plus the cordial reception that awaits private aircraft touching down in this hospitable city.

The spacious terminal building is a gathering place for the private pilot and the executive aircraft owner, who have been without a comfortable headquarters for nearly 20 years. The lounge has several groupings of comfortable divans and hours of hangar flying are logged at the coffee bar and snack shop.

An executive conference room is exquisitely furnished and decorated. Here the transient business aircraft owner can call an executive meeting in Albuquerque without leaving the airport.

A staff of 25 operates Coronado on a 24-hour basis.

Designed to accommodate any general aviation aircraft, Coronado's two runways are 3,300 and 3,500 feet long. Altitude of the airport is 5,200 feet above sea level.

All runways have clear approach. There are no buildings or utility lines to interfere with normal runway operations for three miles in all directions. Visiting pilots are constantly praising the careful planning and position of the runways. In fact, it is often said at Coronado that the very first obstructions to the south, north and west are 70 miles away.

In all, Coronado Airport can accommodate 200 planes on tiedown with 70 more stored in the 36 individual hangar units and one large storage hangar.

Since its opening last year, Coronado Airport has been handling an increasing number of takeoffs and landings every day. There is no congestion at Coronado, on the ground or in the air. In fact, a total of ten paved acres are dedicated to hangars, automobile parking and tiedown facilities.

ON arrival at Coronado the transient pilot is treated like a visiting monarch. Courtesy cars from the ultra-modern Ramada Inn are on call and the airport is an agent for the Hertz Rental Car System. Direct telephone lines are available to the pilot seeking weather information or desiring to file a flight plan.

Coronado's terminal building also serves as a display and sales headquarters for Albuquerque by Aviation, Inc. who handle Cessna aircraft. A brand new 1961 Cessna is always in the display room for public inspection, and Coronado's own commercial fleet is Cessna-equipped.

Coronado personnel operate a modern maintenance and repair shop and a well-stocked parts department. Coronado keeps a staff experienced in servicing all makes and models of lightplanes.

Charter flights, ambulance trips, aircraft rental, aerial photography, flight instruction and a ground school round out the commercial facilities.

The new airport, handling transient aircraft 24 hours a day, has an assigned Unicom frequency of 122.8 megacycles. Its precise map location is 18 air miles from Albuquerque omni on a heading of 40 degrees. In weather, it is possible to make an instrument letdown at Kirtland Air Force Base and proceed northward VFR to Coronado, or a radar approach direct to Coronado can be requested.

New Mexico weather, though, rarely calls for instrument or radar approaches. As one executive aircraft owner from Pittsburgh said, "I didn't know there was so much blue sky in the whole world."

SPECIAL events for the Albuquerque sportsman pilot, such as the recent handicap air race to the El Paso International Airport, are constantly being planned at Coronado. Similar events will be staged in the future and Coronado will also become a terminal point for sportsman pilot races from Denver, Dallas, Salt Lake City and California.

Coronado is also headquarters for the Albuquerque Soaring Club, which keeps its two-place sailplane and tow plane in one of the T-hangars.

One fundamental problem still facing Coronado at this point is the matter of acquainting the entire general aviation community with its location.

Architects and engineers already have been commissioned to draw up expansion plans. When these are complete, there will be no better-equipped private airport in the southwest.

A fine restaurant with a spacious observation deck is on the drawing boards, along with a 60-unit air-hotel where pilots can tiedown their planes directly outside their living quarters. The present maintenance facilities will be enlarged to house a complete electronics shop.

The airport's name dates back to the early part of the sixteenth century, when the famous Spanish explorer Francisco Vasquez de Coronado led his helmeted Conquistadors from the banks of the Rio Grande across New Mexico and into Oklahoma and Kansas in search of the fabled Seven Cities of Cibola, where legend said that even the plazas were paved with gold.

New Mexico historians who have charted Coronado's course along the Rio Grande Valley reckon that the hardy Spaniard may have crossed Coronado Airport property many times on his way around the picturesque Sandia Mountains into the Pecos Country in his fruitless quest for gold.

In the Twentieth Century, rock hounds and student archeologists have found Indian arrowheads and other artifacts of those early days. The insignia of the new Coronado Airport carries the helmeted figure and coat-of-arms of the legendary Spaniard. And this Coronado might as well be paved with gold for the adventuring pilot. END

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I Learned About Flying

(Continued from page 56)

reason for flying 200 miles off course and heading toward Chicago to find Kentucky.

In the ship by ourselves we found we had flown a half-circle and were farther away now than we were at Indianapolis, an hour ago.

It was too late to turn back, we couldn't stay here, and we needed gas; Terre Haute was the next stop.

As we entered the pattern at Terre Haute, the tower was dark, but a large four-engine transport on the apron was running up beside a small hanger and some important-looking buildings. When we entered our base leg, the runway lights came on. We knew since our mike had gone bad they had seen us and given the OK for us to land on the long runway.

I turned to the left after completing my landing roll, picking a point half-way between the runway lights, for the transport was taxiing in to takeoff position behind me. I had just cleared the runway between the lights when my airplane stopped rolling and began to shake itself apart.

I cut the switch, Jim grabbed the flashlight, and we climbed out. I was last out, and by this time Jim was holding the flashlight beam on a prop with new ends, six inches shorter, and like toothpicks on the tips. Below it was a three-foot sheet-steel sign, unlighted, saying, "5,000 feet". Turn back now? I should have hung up when the phone rang at 5:30 that night.

We let the ship set and with a weak flashlight stumbled through the black night toward the buildings.

When we reached the apron, a small army appeared around us, asking a dozen questions at once. Who are you? How did you get here? Where did you come from? When I found my voice I explained that the airport had turned the runway lights on so I could land, and that I thought this was Terre Haute. I was told it was, but I was on the military side of the field.

I was escorted back to my airplane, and saw that I would not be flying anymore that night. Jim took a bus to his post.

At 8:30 the next morning I ordered a new prop and filled out an accident report at the airport manager's office. The prop was flown in from Vincennes, and a new compass was installed.

Headed toward home, with the sun breaking through the overcast I reviewed the recent events so that I would never be caught short again at night.

First the compass. It registered accurately on the ground till the tail raised for takeoff, then it was sluggish, sticking on a southwesterly heading. After I had purchased the new compass, I discovered that the old one merely needed more fluid; filled, it worked perfectly.

The low frequency radio was corrected by adjusting the voltage control. A good mike put my transmitter back on the air.

New batteries for my flashlight and a landing light would have saved the $160 A & E bill and any omni or ADF would have helped my navigation.

Never again will I fly a hurried flight plan without a thorough preflight check on these points. END

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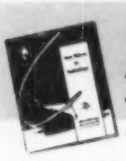

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Future Lightplanes

(Continued from page 25)

aircraft use is a fine noise dampening quality. Fiberglas airplanes will be noticeably quieter than those made of sheet metal.

Aeronautical scientists have talked for at lease three decades about impressive performance improvements which are possible if the boundary layer of slow-speed air enveloping an aircraft in flight could be "controlled". Many wind tunnel tests have been run which theoretically show that this "control" is possible. However, there have been several spectacular failures in the flight testing of experimental aircraft in attempts to prove that boundary layer control would work under operational conditions. These failures and the bad publicity resulting from them largely obscured a few flight test aircraft that used boundary layer control successfully at subsonic speeds. Even more important, the successes in boundary layer control became accepted in the early 1950's when the critical development problems were in supersonic aviation and long range rockets. The military decided at that time that money should be spent on these problems rather than pursuing subsonic aircraft projects such as boundary layer control.

Today, however, this trend has been reversed, and after a few more years of productive research in the field the military is sponsoring two boundary layer control aircraft projects which have the potential to revolutionize private flying as well as some phases of military aviation. The lightplane manufacturers are following these projects extremely closely.

The first project is being funded by the Air Force and engineered by Northrop under the technical direction of W. Pfenninger, one of the European pioneers of boundary layer control who has been with Northrop for many years. The object of this work is to reduce the drag of high subsonic speed aircraft by 30 per cent or more. To accomplish this, it is necessary to maintain laminar flow over the complete wing and tail and most of the fuselage rather than just around the leading edge of the wing and tail and the forward portion of the fuselage. If the boundary layer can be prevented from passing through a transition from laminar to turbulent flow, as it usually does, then the skin friction drag can be lowered significantly.

A modified Douglas B-66 bomber called a laminar-flow airplane will be used in the Northrop project. The boundary layer on its wings will be kept laminar by sucking air into the wings through spanwise slots and then exhausting it out of the rear of the fuselage. Tests have shown that these slots will not weaken the structure. The air drawn in through the slots is out of the very low-energy boundary layer flow next to the skin. As this low-energy air is removed, the speed of the boundary layer can increase. It is the slowing of the boundary layer air which causes high friction drag.

There is another drag benefit from keeping the boundary layer moving rapidly. After an uncontrolled boundary layer slows down and makes the transition from the laminar to turbulent flow condition, it continues to slow down and finally separates from the aircraft's rear surfaces, leaving a dead air zone. This dead air region causes the pressure drag of the airplane. Pressure drag almost can be eliminated with the Northrop system at subsonic speeds.

Flight tests with the Northrop slotted system on a small section of an F-94 wing showed that laminar flow could be maintained over the entire wing chord and that there was no pressure drag due to separation. The current test program is due to get under way in January 1963 after the modified B-66 makes its first flight. It has been estimated by high Air Force officers that if the system is completely successful, the weight of the B-52 could be reduced from 400,000 pounds plus to around 225,000 pounds and still do the same job. This could also be translated into a 30 to 40 per cent reduction in fuel consumption or increase in range for the private flyer.

The second military experimental boundary layer control aircraft is Army sponsored. Effective boundary layer control is only one of its test objectives because it combines new concepts in structures and propulsion as well as aerodynamics.

THE principal objective of the Army airplane is to achieve a speed range of 10, which means that its top speed of 350 mph will be 10 times higher than its 35-mph stall speed. Its installed power will be only 250 hp. This experimental aircraft clearly has revolutionary implications, for the speed range of most efficient subsonic airplanes today is less than four. The concept and design for this aircraft, designated the Marvel, originated at Mississippi State University with a group headed by August Raspet (who was killed in an airplane accident last year). Construction of the Marvel, which is made entirely of fiberglas, is being handled by the Parsons Co. of Traverse City, Mich. Its powerplant will be an Allison T63–250-hp turboprop that weighs little more than 150 pounds.

The light weight of this engine allows it to be placed in the tail of the airplane. In the past, aircraft with pusher props had to have their engines located under the wing near the center of gravity to achieve proper balance. This meant using a long, heavy and troublesome driveshaft between the engine and the prop.

A shroud has been placed around the propeller on the Marvel so that its powerplant essentially becomes a high bypass ratio turbofan with high static thrust for the takeoff and landing and maximum propulsive efficiency for cruise near 300 mph. The shroud improves the static thrust about 60 per cent over that attainable with an open prop. The objections which usually would be raised over the drag of such a large diameter fan on a small aircraft have been overcome by eliminating the normal empennage and using the shroud for stabilization and control. Four moveable surfaces are used in the shroud for pitch and yaw control.

The boundary layer control system on the Marvel is a suction type also, but its suction is applied through many small holes drilled in the upper wing surface and crucial areas of the fuselage such as wing and landing gear junctures. In the neighborhood of one-half million holes, about

(Continued on page 80)

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(Continued from page 78)

.030 inches in diameter will be drilled in the Marvel wing. Exhaustive structural tests have shown that they will not affect the strength of wood, aluminum or fiberglass wings, when taken into account in the original design. The objective of the first boundary layer control system on the Marvel is to achieve high lift for short takeoff and landings, rather than low cruise drag. This system has been proven on several flight test aircraft after several years of testing. On one of them, a Piper L-21, the maximum idle power lift coefficient was nearly doubled with an increase from 2.16 to 3.98. It was more than doubled on the other aircraft, a Cessna L-19, which had a maximum lift coefficient at idle power of 4.60 using boundary layer control and 2.23 without it. In each of these cases about 10 hp were required to run the boundary layer control pumps, which eliminates the argument that the power could have been applied just as effectively through the propeller.

The high-lift boundary layer control (BLC) system also will reduce drag at cruise speeds, but not as effectively as one designed specifically for this purpose. A low drag system has been tested successfully on a sailplane at Mississippi State. The ultimate research goal on the Marvel is to combine the high-lift and low-drag BLC systems on a single wing. To date this has not been possible because the systems require different hole patterns and pumping pressures. Current research indicates that it probably can be accomplished so that the Marvel would end up with a landing speed of 35 or 40 mph and a top speed over 500 mph. Its speed range then would be approximately 14.

Another major feature of the Marvel is that it has a camber-changing wing rather than conventional flaps. Fiberglass construction allows the whole wing to be bent smoothly into a highly curved airfoil for high lift, avoiding the sharp break in contour created by the usual high-lift flap. This device has been used on sailplanes in Germany for some time.

First portion of the Marvel test program is now underway. A prototype airplane, the Marvelette, which incorporates some of the Marvel features, is under test. It uses the fiberglass, boundary layer control, camber-changing wing and the ducted fan-empennage arrangement of the Marvel, but it will have a reciprocating engine in the middle of the fuselage instead of the tail-mounted T63 turboprop.

NO delivery date has been set for the T63, which is still under development, but it is probably at least a year away.

The Marvelette will allow the main elements of the Marvel design to be tested and proven separately from the new engine. Performance of the Marvelette is expected to be exceptional by current standards with a stall speed of 35 mph and a top speed of over 200 mph for a speed range of better than 5.5 out of a 90-hp Continental engine.

The newest aerodynamic development to show great promise for high-speed lightplanes is the variable-sweep wing. This design concept was largely rejected by all aircraft manufacturers during the early 1950s because of the disappointing performance of the experimental X-5 and XF-10F variable-sweep wing airplanes. The main drawback of these aircraft was that their wings had to be moved forward as the sweepback angle increased. The forward wing translation was necessary to keep the center of lift from moving so far back of the center of gravity that the aircraft would become excessively stable and therefore uncontrollable with a horizontal tail of reasonable size.

In recent years the research engineers at the Langley Research Center of the National Aeronautics and Space Administration who were instrumental in the early variable-sweep work have continued to study the problem. It has been only in the last year that they have sold the aircraft industry on a new, simplified type of variable-sweep wing. This wing does not have to be moved forward as the sweep angle increases and as a consequence the mechanism which changes the sweep can be of very light construction compared to that used on the X-5 and XF-10F.

It has proven possible on the new wing to shape the wing root and fuselage so that the center of lift does not shift as the wing is swept through very large angles. For instance, some designs now under consideration will take off with a wing sweep of about five degrees. Then as it climbs and accelerates to cruise speed, the wing is swept back to about 85 degrees. To

(Continued on page 82)

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(Continued from page 80)

achieve this severe sweepback, a large portion of the wing is actually tucked into the rear portion of the fuselage like a closed jackknife.

The reduction of wing area which accommodates the variable-sweep angle provides the airplane designer with a long-sought tool—the ability to size the wing properly with a large area for takeoff and landing and a very small area for high-speed flight.

Every major aircraft manufacturer is working exhaustively with these variable-sweep, variable-area wings. A large number of airplanes using them already have been proposed to the military, ranging from fighters to transports. The performance potential of these wings extends into the lightplane field as well.

There are several objections which undoubtedly will have to be overcome before private aircraft that cruise above 400 mph with sharply swept back wings will become commonplace in the United States. Probably the most serious doubt in most minds centers on the ability of the average private pilot to handle high subsonic speed aircraft.

Experience will have to prove what the average private pilot is capable of, but there is good evidence that he could fly a fully modern 400- to 450-mph airplane with no trouble. Knowledge of stability and control at high subsonic speeds has increased substantially since the first transonic fighters, such as the F-86, were designed. Today it is possible for high subsonic-speed aircraft to be completely stable both statically and dynamically without any form of stability augmentation.

Perhaps more important is the fact that with modern design, landing speeds do not have to be increased over those of current lightplanes in order to cruise at 400 mph or better. Both variable-area – variable-sweep wings and boundary layer control provide low-speed landings with easy to manage straight wings. No one has to worry about the private pilot trying to land something like an F-86.

Regardless of what changes occur in private aircraft design, the U.S. lightplane industry will take on another resemblance to the auto industry in the next few years. It will receive increasing competition from European firms which will not have to risk as much as U.S. manufacturers by pioneering radical design innovations. END

Vertol 107

(Continued from page 27)

of 400 degrees C. An overshoot of TPT may necessitate cutting the engine and restarting it. With the number one engine stabilized, the rotor brake is released to bring in the generator to operate the accessories. In the event either engine should fail during flight, both the hydraulic system and the generator, by operating off the rotor system, will remain intact.

With both engines running and the levers pushed into the flight governing range the "beep" trim switches, located on the end of the collective are applied for fine adjustments to bring the rotor to its 258 rpm maximum and the engines to 100 per cent.

Takeoff from LaGuardia Airport, New York, was into a cross wind of 18 knots from the northwest. Hovering out of ground effect for clearance across the active runway at 14,000 pounds required little control pressure, and vibration was negligible.

Normal cruise for the prototype is between 115 and 120 knots. The pressures necessary for control response are minimal and will be a pleasant surprise to old hands at helicopter flying. Due to this immediate response there is a tendency to overcontrol the aircraft initially, especially the directional control pedals when maneuvering in turns.

The control system components are the conventional control stick, directional control, and collective pitch lever type with a longitudinal stick positioner and control centering devices. The controls are powered by two independent hydraulic systems to provide an optimum of reliability.

A key feature of 107 controllability is the stability augmentation system (SAS) which gives the helicopter positive dynamic stability about all three axes and makes sustained instrument flight feasible throughout the entire speed range. Provided as an integral part of the axes, the helicopter's motions are sensed by gyros in the SAS and, through electronic amplifiers and differential actuators corrective signals are fed to the rotor head without any motion in the pilot's controls. This allows the pilot to establish attitudes and headings desired under a stable flight condition.

Within a year after New York Airways receives its first 107 an instrument program is expected to be under way to more fully utilize the new aircraft. NYA representatives have already begun attending familiarization courses on the 107. Present plans also call for the SAS to be implemented with Lear autopilots to be installed on two of the aircraft prior to delivery. Provisions also will be made for anti-icing equipment in the rotor system for easy installation when scheduled instrument flight becomes a helicopter reality. The automatic turbine speed governor is an aid in overall handling and an additional aid to instrument flight by relieving the pilot of constant manual adjustments of the engines.

Increasing power in cruise while maintaining altitude brought the prototype toward its redline speed of 130 knots (production models will have a VNE of 141 knots or 162 mph). An increase in vibration could be felt as airspeed built up, mainly in the directional control pedals, but it was not appreciable and did not affect controllability.

In the event of engine loss, the automatic fuel control senses the loss and increases fuel flow to the engine still in operation to automatically maintain the rpm set on the governor.

Single-engine landing is accomplished with normal approach procedures for twin-engine operation. Sixty knots are carried through 150 feet and a slight flare is executed to dissipate airspeed. The application of collective checks the rate of descent for a smooth touchdown on the main gear first.

The landing gear on the 107 has the twin tire nose wheel located under the aft cockpit floor and is full swiveling through 360 de-

(Continued on page 84)

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Take this cylinder hold-down stud, for instance. Although its actual length is only 1.800″, its specifications include a dozen or more exacting dimensions, from overall length and width to thread taper and chamfer. For strength and durability, these specially designed threads must be rolled, not cut. Its cadmium plating must be accurately deposited thread to thread. Proper control of metallic composition and hardness are extremely important.

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(Continued from page 82)

grees. A cam arrangement automatically rotates the gear to longitudinal alignment when airborne, and a locking mechanism permits parking on a slope by preventing castering.

The two main alighting gear also have twin tires, and the struts, attached to the outboard end of the stubs, are equipped with single disc type brake assemblies actuated by depressing the toe of the corresponding directional control pedal.

Normal landing poses no problem as the fine control response is quite marked during final touchdown.

There is negligible vibration in the transition from forward to hovering flight.

The control pressure required to perform maneuvers from a hover are again minimal. Turns about a spot, sideward and rearward flight are all routine in the 107.

Vertol's claim that the longitudinal control provided in tandem helicopters makes center of gravity restrictions no problem was substantiated during the evaluation. In a downwind rearward flight condition the control limits were never close to being imposed upon, and small longitudinal cycle adjustments were sufficient to maintain both increases and decreases in rearward speed. (CG travel of 60 inches allows indiscriminate seating and permits passengers to move about in flight.)

The 107 offers additional versatility in being water-operable since the hull is sealed during fabrication. This provides primary buoyancy while the landing gear stubs furnish additional buoyancy and basic lateral stability in water operations.

The water approach as evaluated in Long Island Sound is handled the same as a land operation; however, the flare angle can accentuate up to 30 degrees and be held until contact with the water is made. This is due to the ample clearance between the aft lifting rotor and the water, and eliminates, to a great extent, the concern during night water landings of misjudging altitude. It is best to touch down with some degree of forward speed and maintain it in the water at 100 per cent rpm to keep the spray from hindering visibility.

THE rounded hull provides a fine landing surface, and water handling is remarkably simple. A running takeoff with either single or multi-engine capability can be affected with no tendency of the nose to pitch and submerge.

The entire fuselage cross section of the Vertol 107 between the cockpit and the baggage compartment is unobstructed space used as the passenger cabin. A variety of seating arrangements, accommodating 22 to 25 passengers can be installed to suit the requirements of the routes being flown. The lower density seating with an optional lavatory can be used for the longer inter-city flights.

The 107 employs a mobile baggage concept for speed of loading. Baggage, mail, air express, and freight are carried in a roll-out container. Located as a part of the aircraft's rearmost section, the container rolls out on overhead tracks and contains shelves on which the parcels and baggage are stored. Toward greater efficiency in ground handling, a second pre-loaded container may be placed in the helicopter at terminal stops for the outbound trip as soon as the inbound container is removed.

Although the vibration level in the 107 is comparable to the best in fixed wing transportation, the noise level of the prototype, while greatly improved over its predecessor, the V-44, still creates a degree of speech interference. However, the transmissions on the prototype were not soundproofed as they will be on the production model.

The ability of the 107 to be rapidly converted into a temporary cargo transport is an item very much on the plus side as far as New York Airways is concerned. All passenger seats can be folded rapidly and stowed against the cabin wall or removed, since all attachments are made with quick disconnects.

In looking at the V107 from an engineering point of view, the gearing and installation of the T-58-8 engines and the overall simplicity of maintenance are the key features.

Maintenance on large rotorcraft has always been both time consuming and costly, requiring several maintenance hours for every flight hour. In an effort to reduce this ratio to a more equitable figure Vertol has gone to considerable lengths.

The cockpit flight controls have been simplified to enable removal as an entire box unit for bench repair or overhaul. Sealed bearings are used throughout the control system to eliminate periodic lubrication.

In the rotor system oil lubricated or

(Continued on page 86)

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Illustrated Brochure on request

(Continued from page 84)

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Gross weight	18,450 lbs.
Useful load	7,290 lbs.
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Height	16 ft. 10 in.
Cabin:	
Length	24 ft. 2 in.
Height	6 ft.
Width	6 ft. 7 in.
Volume	850 cu. ft.

Performance:

Max. speed (sea level)	162 mph (141 knots)
Cruising speed (sea level)	155 mph (135 knots)
Max. rate-of-climb (sea level—maximum continuous power)	1700 fpm
Engine out maximum rate-of-climb (sea level—takeoff power)	290 fpm
Hovering ceiling (out-of-ground effect—takeoff power)	6,500 ft.
Fuel consumption (cruising)	1,310 lbs./hr.
Range (full capacity, range includes 10% reserve)	215 naut. mi.

Engines: Turbine—two General Electric shaft turbine—CT 58. Takeoff power—1,250 shaft horsepower maximum continuous power—1,050 shaft horsepower)

Rotors: twin rotor—two counter-rotating metal rotors in tandem, each 50 feet in diameter and each having three articulated blades.

Alighting gear: Amphibious capability.

The forward rotor transmission clamshell cowling incorporates an integral work platform. The aft transmission clamshell cowling incorporates work platform steps leading to the rotor hub area.

In speaking with Leslie G. Carter, vice president of operations for New York Airways, after the flight, many facets of the new operation were discussed. Important among these especially to the taxpayer and to potential operators, was the V-107's low seat-cost-per-mile. With expanded routings the 107 could be the instrument through which government subsidy would be eliminated as the financial prop for major commercial helicopter transportation. END

How Clean Is Your Fuel?

Even the most forgiving airplane can turn nasty if its gasoline diet gets contaminated with water, dirt particles and other non-combustibles. Perhaps you know and observe the precautions necessary to avoid fuel contamination in your plane. But, in the interests of safety, let's review the basics:

DRAIN FUEL SUMPS. Notice that plural: sumps. On your pre-flight, it pays to drain a few ounces, not only from the main gascolator, but from the wing tanks themselves. This gets rid of moisture and sediment that accumulates on the bottom of the tanks and does *not* get cleared out through the gascolator. (Quick-drains are now available as an accessory for most light planes that do not already have them.)

TOP YOUR TANKS. Make sure those tanks get filled *before* you put your plane away for the night. This will prevent condensation from forming on the inside walls of your tanks—the same type of moisture you often see on the *outside* of your plane early in the morning.

One more tip: use all your tanks. Avoid letting gasoline "sit" for month after month in an auxiliary tank. Keep your fuel "fresh."

Follow these rules and you'll help keep your plane's gasoline diet pure and healthy. Incidentally, you might be interested in knowing something about the systems your Gulf aviation dealer uses to insure delivery of absolutely clean Gulf aviation gasoline into your plane.

Notice another important plural: systems. That's because your Gulf aviation dealer has what amounts to *three systems* working in combination to keep the fuel pure. Here's how they operate:

WATER-LOCKING FOOT VALVE. This is a special safety device installed on the suction pipe in every Gulf aviation gasoline storage tank. The water-locking foot valve floats in water but not in gasoline. So, if any water were to get into the gasoline storage tank, bang! . . . the water-locking foot valve would immediately close off the suction pipe and nothing could be pumped until that water was drained off.

MICRONIC FILTRATION. This is Gulf's filtering system at the pump, and it's so effective it will screen out any solid particle down to 10 microns in size. And that's pretty small, because a micron is 39 *millionths* of an inch.

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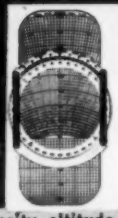

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Small Turbine

(Continued from page 29)

can be essentially the same as for a simple jet engine.

- Conventional, off-the-shelf propellers can be used with no risk of high drag conditions occurring accidentally.
- A free power turbine can rotate opposite to the compressor drive turbine, allowing an acceptable level of efficiency out of only one stage each, driving the nearly six-to-one pressure ratio compressor, the other the power output shaft.
- Starting requirements are eased, as the starter does not swing the main gearbox or any part of the load (particularly important in cold weather).
- Torque-converter properties of the free-power turbine make for a broader range of speed-power combinations, at a better fuel consumption, than would a single shaft engine of comparable thermodynamic design. (Designers reversed the conventional engine layout in the PT6, avoiding use of concentric shafting).

Most installations will utilize a scoop-type cowling inlet. Air enters the engine near the rear of the nacelle, similar to the carburetor scoop position on piston-engine aircraft, and is compressed by a single compressor assembly connected with the first turbine.

The second, or free turbine, is spun by the gas flow from the first turbine, and is directly linked through reduction gearing in the nose section to the propeller shaft. Exhaust gases are discharged through twin ports on each side of the nacelle aft of the nose section.

Additional refinements are tied to this powerplant, many of which are incorporated in the larger JT12 turbojet (produced in the East Hartford, Conn., facilities of Pratt & Whitney, which shared the design work with the Canadian company).

All accessories are maintained within the 19-inch diameter of the engine. Drive pads are available on this rear case for a 200-ampere starter-generator, hydraulic pump, vacuum pump, tachometer and an extra power takeoff as well as the drives for the Hamilton Standard JFC-50 hydro-mechanical fuel control (including sandwich fuel pump) and the multi-element combination scavenge and pressure oil pump.

For the turboshaft output of 6,230 rpm, one planetary stage of reduction gearing is used. For the turboprop engine, a second planetary gear stage is used to reduce the output to 2,200 rpm. The turboprop is equipped with a flanged propeller shaft; the turboshaft engine output shaft is flanged to accommodate a flexible-type coupling.

The nose case of the PT6 incorporates drives for the propeller (or free turbine) governor, an optional propeller topping governor, free turbine tachometer, and the oil pressure pump with dual oil scavenge elements. An overspeed limiter is fitted to the free turbine shaft which cuts fuel flow to the gas producer in event of possible unloading of the drive system.

The annular-type combustion chamber is fitted with 14 simplex nozzles, spraying fuel into the primary air flow which is admitted through louvers at the outer diameter of the combustion chamber. Seven of the nozzle supports also act as flame tube supports, permitting radial expansion of the combustion chamber while retaining its axial location. Fuel nozzles are individually removable for ease of maintenance. They are linked by an external fuel manifold.

A "HOT-END" inspection may be made by splitting the engine at the exhaust flange, removing the nose case including reduction gear section, exhaust case and power turbine. Both the free power and gas generator turbines are visible for inspection and, if necessary, replacement, without disturbing the remainder of the engine.

Canadian Pratt & Whitney is using five of its nine test cells for the PT6. In conjunction, altitude calibration and additional compressor development work is also being conducted at the Pratt & Whitney Willgoos Laboratory (turbine test facility) in East Hartford, Conn.

While studies on the PT6 began in 1958, detailed design did not begin until early 1959. The Canadian firm, founded in 1928, has in recent years earmarked over 90 per cent of its production for export to over 50 countries.

In addition to the Pratt & Whitney aircraft division, it represents other United Aircraft divisions in Canada; it is a complex of aircraft engine and spares manufacture, the sales and service of Sikorsky helicopters, and Hamilton Standard propellers and aircraft accessories. Factory space approximate 850,000 square feet; employees number almost 3,000. END

PT6 SPECIFICATIONS

PT6A-3 Turboprop:

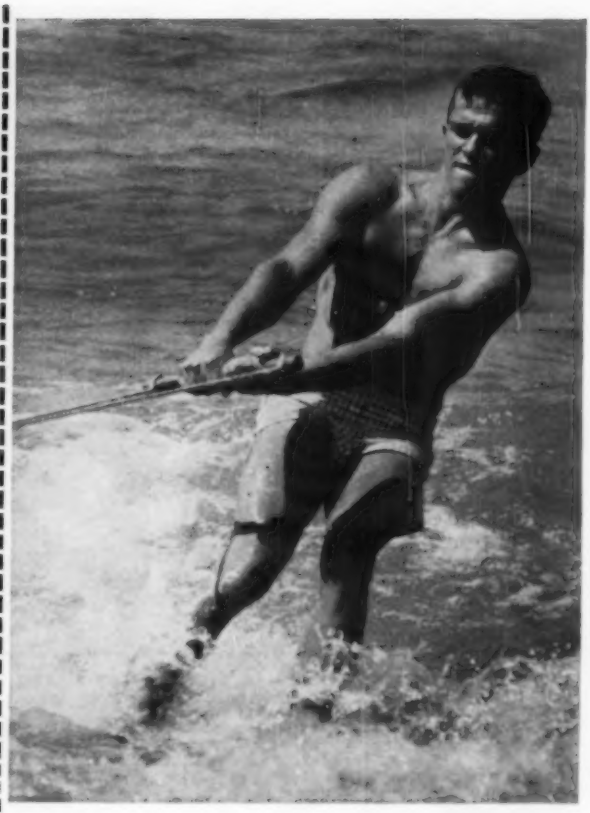
	ESHP	SHP	Prop. RPM	Jet Thrust (pounds)	JP-4 Fuel Cons. lb./eshp/hr.
Takeoff	500	466	2,200	85	0.69
Max. Continuous	450	418	2,200	80	0.71
Normal Rated	400	371	2,180	73	0.73

(Dry weight shall not exceed 250 pounds. Diameter 19 inches; length 61.5 inches)

PT6B-3 Turboshaft:

	SHP	Shaft RPM	JP-4 Fuel Cons. lb./shp/hr
Takeoff	500	6,230	0.70
Max. Continuous	450	6,230	0.72
Normal Rated	400	6,230	0.74

(Dry weight shall not exceed 225 pounds. Diameter 19 inches; length 58 inches)



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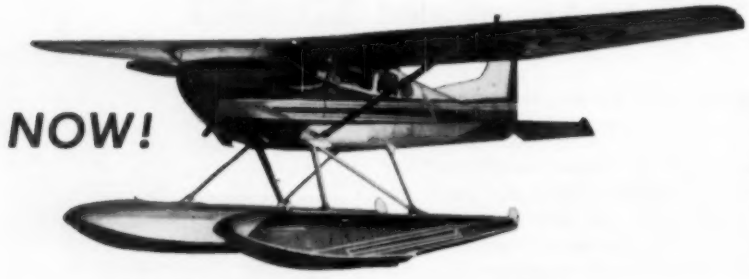

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Mitchell Autopilot

(Continued from page 35)

while tracing ATC instructions over a briar patch of airways, intersections and holding patterns.

For example, before takeoff a given climbout heading can be selected on the Mitchell automatic pilot. This is done by rotating an azimuth ring mounted around the face of the directional gyro, and marked off every 45 degrees with indices to permit programing turns. The climbout heading is placed opposite the top index mark, and after takeoff the roll servo is engaged with a knob on the control console. Then the turn knob mounted above the DG is pulled out and the aircraft turns to the selected heading.

Compass points on the azimuth ring are laid out in a counterclockwise manner—opposite that of a compass dial. This feature proved slightly uncomfortable to this editor, but Denhofer said the arrangement is designed to permit the pilot to rotate the azimuth ring left for a left turn and right for a right turn.

A useful feature of the Commander is that, unlike many simpler heading lock systems (including Mitchell's own Co-pilot) a fully rotating directional gyro is utilized. It is not necessary to place the DG on zero for a setting where gyro precession is negligible. Therefore the pilot has the full use of his DG for instrument work.

Before takeoff we checked out the autopilot. First the master switch on the console was turned on, and then the roll servo engaged. The turn knob was twisted full left and then right, and the control wheel responded with a slow, steady turn in each direction. The same was done for pitch, and the control yoke moved slowly back and forward. Then both servos were disengaged and the DG set by the compass and uncaged.

Asked if the automatic pilot could be overridden during takeoff if inadvertently left engaged, Denhofer said a slip disk in the roll servo permits it to be overpowered with a 16-pound force. The pitch servo can be overpowered with an 18-pound force, he said, and can be completely disconnected with a 30-pound force by means of a safety breakaway link. A sharp rap easily does it, as this editor quickly found out, and there was a short delay before takeoff while Denhofer crawled under the control panel and repositioned the breakaway pitch control linkage.

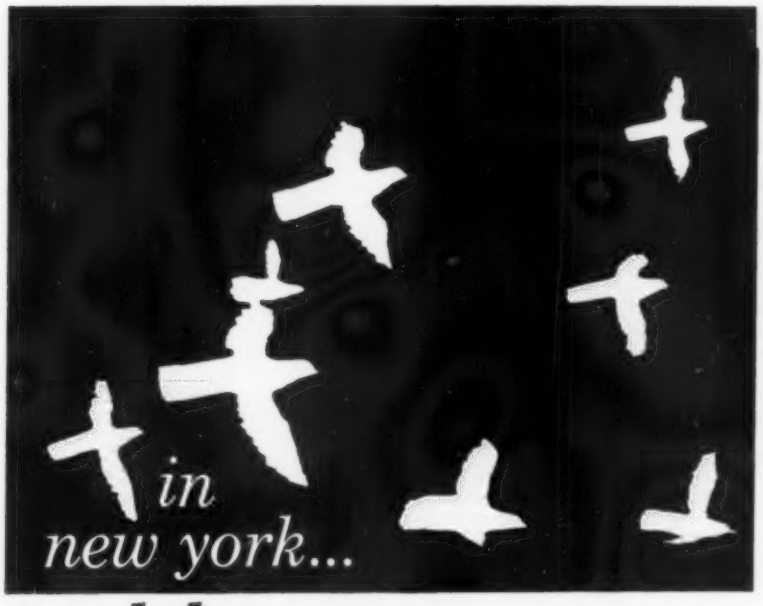
While in flight, the roll servo easily can be yanked off a heading in case of an approaching aircraft with only moderate pressure on the Comanche control wheel. It takes a good healthy push to overpower the pitch control.

The auto pilot is not FAA approved for single-engine operation in twin-engine aircraft.

The climbout was made with automatic heading control, and we leveled off at 3,500 feet and set up a cruise of 160 mph IAS.

First we tried a series of turns with the automatic heading selector. The aircraft makes a prompt but gentle turn as soon as the azimuth ring is rotated to the desired heading. Maximum bank in the test aircraft was a mild 10 degrees. Denhofer said

(Continued on page 92)



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(Continued from page 90)

newer versions of the Mitchell autopilot are set for a 15-degree bank.

The turns are uncoordinated because the Mitchell unit has no rudder control, but the rolls are so gentle that the ball moves only slightly from the center of the race in the rate of turn indicator, and no yaw can be felt.

From five to eight degrees before the selected heading, the Commander began an extremely gentle rollout and eased out on the correct heading.

If the pilot desires a greater degree of bank, such as to adjust the rate of turn for a one- or two-needle width turn in a holding pattern, the trim knob is used. With this the aircraft can be rolled into another eight degrees of bank. If more bank is desired, the turn knob placed on manual gives a maximum bank of about 28 degrees. This extra flexibility offered by the turn knob is provided in a similar manner for pitch control, and the aircraft can be guided in turns and climbs or descents by these controls alone, separate from the automatic heading and altitude controls.

When the bank is increased over that given by the automatic heading control, a rollout of about five degrees over the selected heading is experienced. But this can be eliminated by turning off the trim control before reaching the desired heading.

The Mitchell autopilot will give a complete 180-degree turn in one step on automatic heading control. In turns to the right, the azimuth ring can be moved promptly to the 180-degree mark. But in turns to the left the pilot must wait until the aircraft has passed through 10 degrees before rotating the azimuth ring the last 10 degrees. Otherwise the autopilot tends to swing first left, and then back to the right to complete the turn.

For a left-hand 90-270 procedure turn, both turns can be cranked in immediately without delay.

As for actual electro-mechanical operation of the Mitchell autopilot, a change in aircraft attitude is sensed electrically through the artificial horizon by inductance changes; a change of heading through the directional gyro by capacity changes. The signals are transmitted through the all-transistorized amplifier to the servo motors engaged to the control yoke. Components are the gyros, amplifier, two servo motors, cables and cockpit presentation.

The Mitchell automatic altitude control showed good ability to stick to a selected altitude, even during full-bank turns on autopilot. After stabilizing the aircraft with altitude control at 2,700 feet, we cranked in a 25-degree bank to the left with the turn knob and let the aircraft make a complete 360. The Comanche lost only about 20 feet at one point in the turn but quickly regained it and finished up right on 2,700 feet.

The maneuver was conducted in smooth air. Denhofer said the aircraft should not lose over 50 feet even in moderately turbulent air under altitude hold.

To sample the Commander's climbing technique, the aircraft was stabilized at 3,500 feet and the automatic altitude control set at 4,500 feet.

(The altitude control presentation installed in the Comanche was not the standard Mitchell unit, but instead was that used in the Piper altimatic system, which is also manufactured by Mitchell Industries. It was slightly off calibration, Denhofer said, and therefore did not give accurate altitude readings. The standard Mitchell unit, which senses altitude independent of the altimeter, has a knob for calibration adjustment.)

The aircraft pulled up promptly but gently into a 1,500 fpm climb. The rate of climb quickly but smoothly dropped to and stabilized at 500 to 700 fpm. The throttle setting was maintained, and airspeed dropped off by 30 mph to 130 IAS. At 500 feet before the desired altitude, the aircraft began an extremely gradual leveloff and finally evened out at 4,500 feet.

It proved impossible to stall the aircraft on autopilot. After setting up 170 mph IAS straight and level, the pitch knob was rotated full up and the aircraft began a 2,000 fpm climb. This dropped to 700 fpm, and the airspeed finally leveled out at about 120 mph. A reduction of power in an attempt to induce a stall merely caused the aircraft nose to drop down slightly until airspeed picked up, and the nose began to rise again.

In a 1,000-foot descent from 4,500 feet on automatic altitude control the Comanche nosed down promptly, but there was no discomfort from the very small amount of negative G induced. The vertical speed dropped to about 1,000 fpm and then smoothed out at 500 fpm. Again the leveloff began 500 feet before the desired altitude, a lead margin that seems almost too wide for the gentle rate of descent on automatic altitude control.

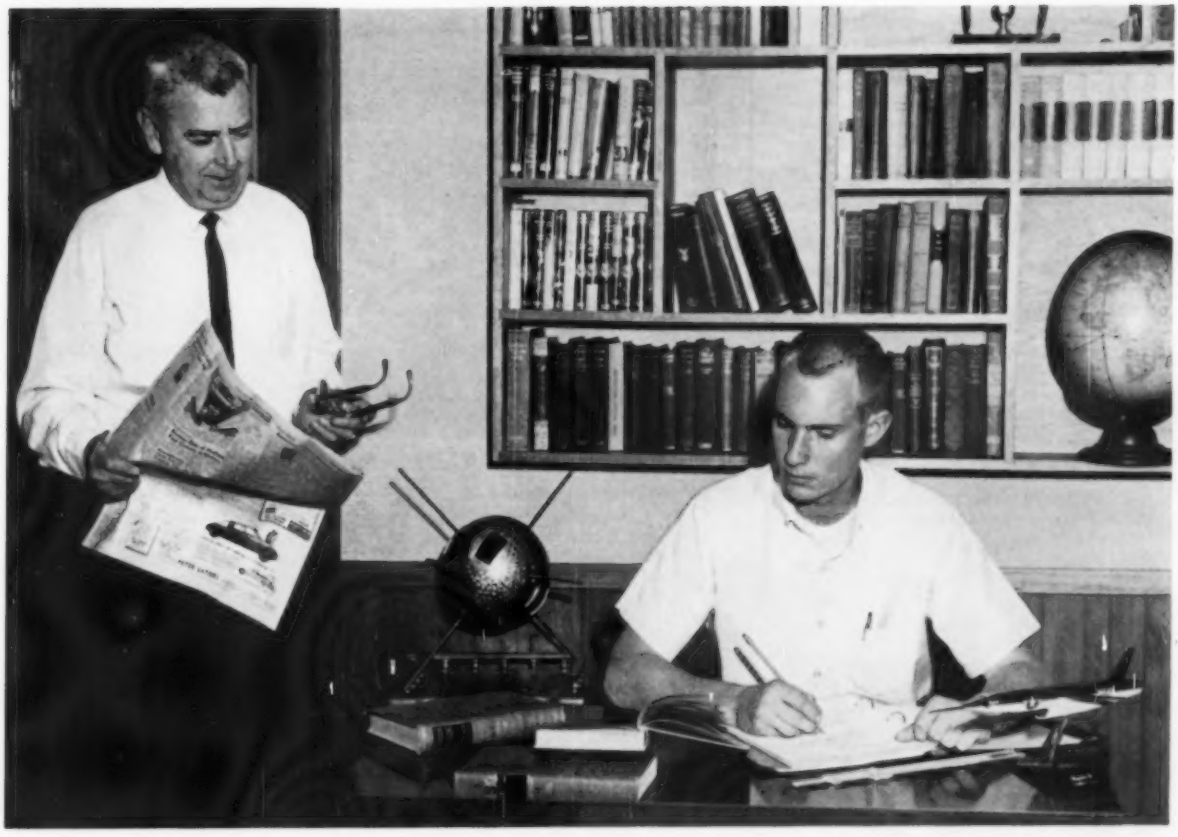
MITCHELL PRICE LIST

	12 volt	24 volt
Co-Pilot (heading lock, roll control)	$1,095	$1,320
Executive Co-Pilot (adds automatic heading selector)	1,480	1,705
Captain (controls heading, roll, pitch)	2,425	2,650
Senior Captain (adds automatic altitude selector)	2,875	3,100
Executive Captain (includes automatic heading selector, not altitude selector)	2,795	2,995
Commander (includes automatic heading and altitude selector)	3,245	3,445

Turning in full pitch trim down, the airspeed mounted almost to the Comanche redline, but dropped off with power reduction. At no time was the pitch angle excessive.

During a descent to the field on automatic pilot to duck an approaching snowstorm, light to moderate turbulence was encountered. The autopilot made very rapid but surprisingly smooth corrections, and had no difficulty in maintaining proper attitude on the Comanche.

The Mitchell Commander automatic pilot proved itself a flexible system with extremely gentle manners. FAA approved for most business aircraft, it will permit almost an entire flight to be conducted "hands off" the controls. END



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Light of the Moon

(Continued from page 49)

the takeoff, landing lights can be switched on if desired. If not, the lights should be at least flashed down the runway long enough to make sure that the runway is clear. This is especially important at a field where no traffic control exists.

At a controlled field, the radio should be tuned for loud, clear reception. The level of reception usually will fade a bit during takeoff and pattern flying, and compensating for this beforehand can eliminate tuning the radio during the climb-out.

Upon receiving clearance for the takeoff, power should be applied smoothly, and don't forget to apply right rudder as required to prevent torque from diverting the airplane from a straight course down between the runway lights. Do not hurry the airplane off the ground at night. If there is ample runway, build up five to 10 mph of extra speed and let the airplane fly itself off.

Perhaps the biggest mental problem connected with a night takeoff (especially for the inexperienced pilot) is that of establishing the climb-out. Once leaving the lighted runway, the airplane appears to plunge into darkness, and it is at this time that flight instruments should be read with a quick glance and all "seat of the pants" feeling ignored. It is rather easy to imagine the wild search for the horizon by a pilot unable to determine an aircraft's attitude by reference to flight instruments alone, particularly on a moonless night.

Unless you positively can identify horizon lights ahead, refer basically to the flight instruments to maintain a heading and a rate of climb. Don't look back to identify lights on the ground, as this is one of the quickest ways to lose your sense of balance and direction. Reference to the ground can be made after a safe altitude (about 500 feet) has been reached.

Because of the reference to flight instruments during the climb-out (keep in mind that the VFR pilot still must watch for other traffic), it is possible when taking off from a strange field to become confused as to the aircraft's actual position upon reaching a safe altitude and also to become undecided which way to turn to get on course. To cope with this situation, here are three tips:

Tip No. 1—When taking off from an uncontrolled strange field, use the directional gyro to climb out on a constant heading for several minutes to gain at least 1,000 feet (above ground), and then make a 180-degree turn and fly the reciprocal heading back to the field. When back over the field, then the aircraft can be put on the proper course.

For example: if the takeoff runway is 23, the gyro compass is set to read 230 degrees and is uncaged as the airplane rolls down the runway. During the climb-out the heading of 230 degrees is held, and a rate of climb of at least 500 fpm should be established. From takeoff, the climb-out is timed for three or four minutes, depending upon the climbing speed of the aircraft. The point to remember here is to gain between 1,500 feet or 2,000 feet of altitude and yet stay within five to seven miles of the field.

When leveled off at the predetermined altitude, climb power is reduced to cruise power, and then a 180-degree turn is made into the wind, if it is from one side or the other. Upon the completion of the turn, the new heading of 050 degrees (reciprocal of 230 degrees) is held to bring the airplane back over the field at an altitude above the pattern altitude. From over the field, usually it is easier to become oriented to pick up the proper compass course and double check it against landmarks.

Tip No. 2—If a navigational aid—either a low frequency range or homer, or an omni station—is located close enough to produce a strong signal at a low altitude or on the ground, use it as your initial datum point for course orientation.

In the case of an omni station, set the receiver to the proper frequency and turn up the volume prior to the takeoff. As the airplane gains altitude upon leaving the runway, the signal will increase in strength and actuate the course indicator and to-from flag. Upon reaching a safe altitude, recheck the tuning dial for loudest signal, turn the course selector to center the L-R needle (with a "to" indication) and fly to the station. When over the station, set the course selector to the outbound course and track out.

If the radio navigational aid is of the low frequency type, it can be tuned in on the ADF prior to takeoff. Again, after a safe altitude has been reached, the ADF pointer is flown to the station. Position over the station is ascertained by a 180-degree reversal of the pointer, and then the course is set up. At this point you can track out by ADF, home to another navigational aid, or combine dead reckoning with some pilotage.

Tip No. 3—One of the most interesting methods for control of a night takeoff from a controlled airport (major air terminal) is the use of radar "Departure Control." This is primarily an IFR departure service supplied by the boys "behind the scopes"; however they usually are obliging with their service for the night VFR pilot.

To request the service, call them on the field telephone before your departure, or as a secondary method, you can ask "Ground Control" to relay your request. If Departure Control can oblige, give them your course or indicate the nearby radio aid to which you wish to be vectored. Be sure to know their primary frequency.

Once alerted, the procedure follows this sequence: ground control is contacted for taxi clearance and the aircraft is moved into the run-up position; upon completion of the run-up and check-out, the tower is then contacted for takeoff clearance.

The tower frequency is monitored during the takeoff, and at a point in the climb-out, the tower will advise to change over to departure control. Here the receiver and transmitter are set up on the predetermined frequency and contact is made.

Upon their initial acknowledgment, De-

(Continued on page 96)

CANADA'S FLYING COPS

A UNIQUE organization in Alberta, Canada consisting of members of the Edmonton police department has been operating since 1955 as the Edmonton Police Flying Club. Organized by authority of Edmonton's police chief, M. E. F. Anthony, the club has now 21 members. Two of them are policewomen, Sally Krowchynski and Olga Miller.

The club's first airplane was a Luscombe, purchased by pooling the resources of 16 members. Presently EPFC owns a Cessna 170B, equipped with a full gyro panel, LF and VHF radio and flashing beacon. Constable Robert Stanton, graduate of Embry-Riddle Aeronautical Institute, acts as flight and ground school instructor.

Though the airplane is used primarily for pleasure flying, it has also performed valuable service to the police department by participating in a number of searches, and ground traffic surveys, and it is at the disposal of senior officers as a means of rapid transportation on official business.

To date, Canada's police flying has been the province of the Royal Canadian Mounted Police, which have a special air division. However, there is a great deal of interest among police departments of various Canadian cities in the activties of the Edmonton Police Flying Club, and its example may lead eventually to the formation of similar organizations by the law enforcing agencies of Canada.

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(Continued from page 94)

parture Control will verify a "radar contact" and from then on it is just a matter to continue the climb and follow the headings as supplied by the ground radar station. Within a matter of a few minutes, Departure Control will get you lined up on course, or over the requested radio aid, while at the same time keeping you posted of other traffic in the area.

• *During flight*—At this point it might be well for the pilot to remind himself that when flying at night, he is faced with the same "cockpit management" as when flying by day. He must concern himself with fuel consumption and the selection of the proper fuel tank, adjustment of trim to relieve the pressure on the control wheel, proper setting of receiver and transmitter to the appropriate frequencies, and a reading of all instruments including the engine group and carburetor venturi temperature (if installed).

Don't become hypnotized by the instruments. Keep looking around; keep oriented. Here is where an instrument such as the Coffing 3-D horizon is of great aid to the VFR pilot as it gives him a familiar reference in terms of wing, nose, earth and sky. Straight and level flight (or turns or climbs, etc.) can be established by referring to the 3-D horizon with the same control reflex and orientation as when referring to the natural horizon during the daylight hours.

Another point of confusion is that sometimes it is difficult to tell whether a light is in the air or on the ground; whether it is moving or standing still. In attempting to identify a light, some pilots unintentionally drop a wing and find themselves actually chasing it.

To prevent this, a veteran airline captain suggests the following: first, make sure that you are holding your gyro heading and that the wings are level. Then line up the light in question with a reference point on your airplane. Now it is easy to tell whether the light is moving, and in what relation to your line of flight.

The new night pilot also should be aware of the difference in flying conditions and visibility on dark nights with an overcast, or on a moonlight night, since the illlumination under each of these conditions is different—and, of course, quite different from direct sunlight. Consequently distances at night are deceptive due to less illumination, and this affects the ability of the pilot to judge them.

THIS also applies to the estimate of altitude and speed. More dependence must be placed on instruments, particularly the altimeter and the airspeed indicator.

Another point of caution is to be alert to the possibility of unintentionally flying into an overcast or layer of fog. This is very easy to do on a dark night, and can be detected usually by the disappearance of lights on the ground, and by the increase of red or green glow in the vicinity of the position lights.

Weather observation from the cockpit is rather difficult on dark nights. Look down at the lights on the ground for some clues. Normally the lights should appear clear-cut; if they appear fuzzy, it is an indication of smoke, low clouds, or ground fog.

Incidentally, the pattern of lights defining a large city reproduce very closely the shape of the city as shown on a sectional chart. Usually it can be seen to glow in the sky above as far as 75 to 100 miles.

A note of caution here—when entering the vicinity of a large city, lights of other aircraft can be lost against the city's glare. If another plane passes closely by, switch on the landing light as a signal, and be prepared to take evasive action.

Lights of other types also serve to aid in recognizing areas or checkpoints. Easy to spot are steel mills, blast furnaces, oil refineries, and large athletic stadiums. Highways, too, make excellent checkpoints, especially main routes which normally handle considerable traffic at night.

AND there is the reverse of the light situation, particularly on a dark night: almost just as much help for a position check is a large area where there is absence of light, such as found over a large river, lake or forest area. However, to use the "dark areas" in this manner, they must be expected in order to identify them.

• *Landing*—The green row of lights at the end of the runway is the spot to make good. These lights can be lined up with a reference point on the nose or windshield of the plane. If the green lights move higher, the airplane is undershooting; if they move below the reference point, then the ship is overshooting.

Many experienced pilots prefer to use partial power when making a landing at night, especially at larger fields with clear approaches. The airplane is flown onto the runway and power is cut immediately when the wheels contact the hard surface. This type of landing offers an advantage in that it enables a pilot to compensate quickly for any errors in judgment on the approach or when levelling off.

A guide to setting up such a power approach is to determine an airspeed equal to 1.5 times the stalling speed (for the particular loading of the aircraft) and maintain it in the power approach by regulating trim on the elevators. Coordinate this with a reduction in power (carburetor heat ON) until the rate of descent is a moderate 300 fpm (glide path permitting).

Use of flaps at this time can give rise to an unusual problem. If no flap is lowered, the altitude of the airplane may be such that the landing light beam may be too high to illuminate the ground. On the other hand, the application of full flap will steepen the gliding angle (correspondingly the angle of the beam of light) and bring the ground suddenly into view. This can cause the pilot to jerk back on the control wheel too quickly and break the glide prematurely. The amount of flap to use in the power glide will vary with the particular airplane, but the range in general is between 10 to 25 degrees.

Thus it can be seen that night flying is different and does call for additional experience and proficiency. Until such a time as a pilot can take night transition dual instruction from a competent instructor, it is best that he set down when the sun does. But when properly equipped, and with the additional experience of night orientation, he can extend his operations and enter a new and interesting phase of flying.

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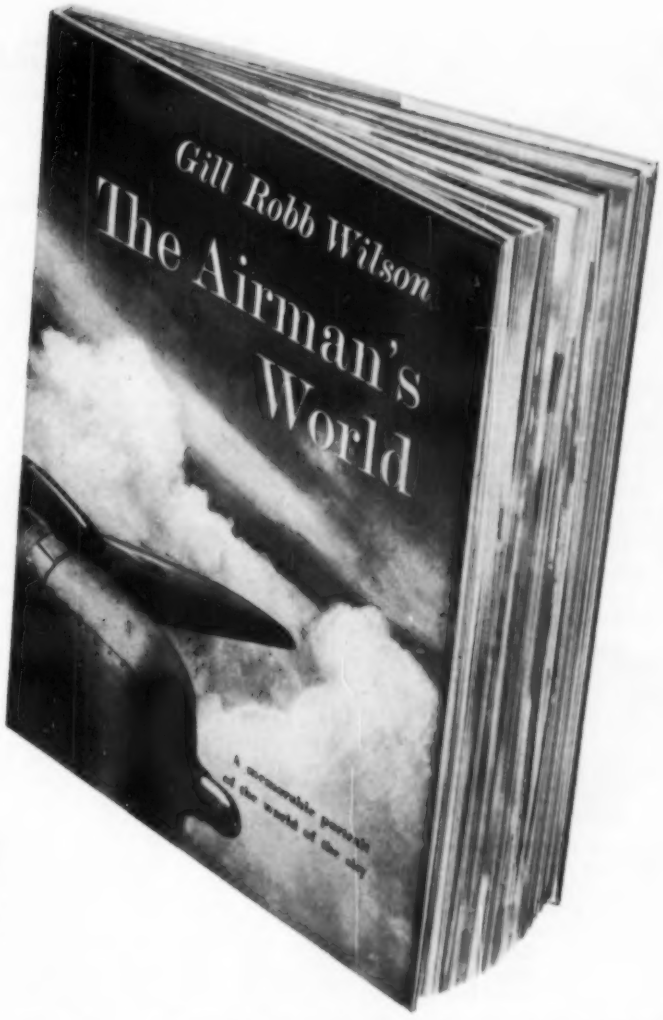

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A WORD ABOUT THE AUTHOR

Gill Robb Wilson was a pilot with the French Escadrille 66 in World War 1, president of the U. S. Air Force Ass'n, president and organizer of many flying groups . . . and is now the noted publisher of *Flying* magazine. He learned to fly just after the Wright brothers successfully propelled their flying machine above the ground, and has been one of the leading figures in aviation ever since. In his book, author Wilson conveys the feelings known only by men who are at home in the sky, and explains this exalting sensation to those who have never flown.

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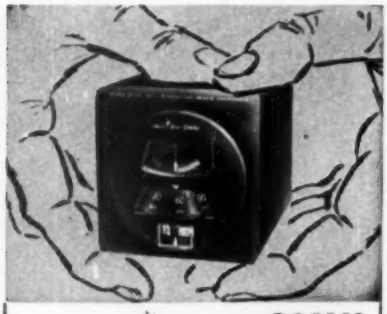

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HANGAR FLYING

DON'T FORGET THE HOMEWORK

I AM CONVINCED that a pilot really learns about flying in everyday flights when he forms the habits that either get him through a tough spot or point up what he has failed to learn. While practicing for my instructor's rating, my instructor and I alternated playing the part of student, although he reserved the option of asking me to perform any maneuver that I told him to do. After one simulated forced landing, I cut the throttle on climbout, at 500 feet, when he told me to make the landing myself. Of course I had a field picked out, and a smooth gliding turn lined us up. I slipped to lose altitude, but even at that I was still high and fast. I eased the nose up to slow the ship and let it settle, and at 75 feet I realized that the stick was all the way back. I pushed full power and forward stick to keep the nose on the horizon, but I never saw an airplane drop so quickly. We didn't touch the ground, though, and were on our way again.

What really saved us that day were the hours that my instructor had made me spend on stall recovery, so that when the time came, the correction was there instantly, from habit. I had read about downwind approaches, but the reading would have done me no good without the good flying habits that my instructors had forced me to learn. A short time later, I was instructing.

I remember one student that I soloed and flew with to his private license. He looked at me questioningly one day when I told him I had never flown a lightplane more than 15 miles on a cross country trip, but had only put eight or 10 trips together when I wanted to go someplace. He came back to the field one day after getting his private and his own ship, and told me about getting caught in restricted visibility in unfamiliar territory. It was only then that he understood what I meant about short cross country trips. "I didn't know where I was, but I sure knew where I had been 15 minutes ago, so I just found myself on the map and flew little cross countries home," he said. Again, my instructors were responsible for making me learn that if you do not know where you are, you had better know where you have just been.

Some time later, I had a student 15 miles from the airport at 5,000 feet for spin instruction. During the first recovery, the windshield blew out of the frame. We opened both doors to relieve the pressure in the cabin and headed back toward the airport. I gradually slowed the ship down and felt the controls get mushy at 70 mph. The rudder pedals felt like someone was kicking them, and when I looked back, the tail section was vibrating. I set up a 75-mph straight-in approach to our 1,800-foot strip, and wheeled it on with no trouble. Again I thanked the fine instructors who insisted that I learn things right and practice for top proficiency.

As I look back, I see that every flight has been part of a continuous education, and an emergency is merely the final exam. Like every other exam, the emergency underlines our weak points, but we had better have a passing grade, or school can be over before the next lesson.

GEORGE E. DORN

Winstead, Conn.

SEVEN LITTLE WORDS

I HAD LEFT Brookley AFB, Mobile, Alabama, in an RF-101 bound for Shaw AFB, S. C. I entered the soup right after takeoff, and while in the climb heard a sharp "boomp"; a check showed that a canopy seal had blown and that I was without cabin pressurization. I continued climbing, as the tops had been forecast to be no higher than 22,000 feet—no problem for my oxygen system. The tops, however, were at 36,000 feet. I tried to contact the center and request a lower altitude, but was unable to reach them. I tuned in Montgomery VOR, identified it, and watched the Radio Magnetic Indicator Swing obediently ahead.

The Montgomery ETA came and went; I waited two minutes past ETA, figuring that my climb had taken me farther away than I had planned. I was suspicious, and turned the VOR volume up to identify the station again. I heard nothing but a great silence. I tuned the Omni back to Brookley VOR; the RMI needle didn't even flicker. I had lost the Omni, but I turned to my Atlanta heading. The weather at destination was certainly better than at Brookley, and there was no need to return. I managed to contact Atlanta Center on their new discrete frequency, informing them of my problems and requesting a lower altitude. I asked for a series of short counts, as the '101 has a UHF-DF system coupled with the command radio. Atlanta soon came back with a hard altitude of 26,000 feet and began giving short counts. I dropped down into solid, dark cloud. The UHF homer worked so well that the needle on my instrument panel swung during a count from Atlanta as I passed over the station. Atlanta cleared me to home on Shaw Tower. Shaw transmitted for me, but my homing needle swung in useless circles. I asked Shaw to give me steers through their homing equipment, but they apologized and said that their DF facilities were inoperative. They handed me off to Shaw Approach Control for a radar pickup. A minute later RAPCON asked for my IFF.

I told them it was on. They were sorry, but were unable to pick me up on any radar. At this moment my UHF transmitter ceased to operate. In desperation, as all my radio equipment crumbled around me, I switched to Guard channel on the UHF. The little Guard transmitter worked, and I was again talking to Shaw RAPCON. I was completely lost by this time, in solid weather, without navigation aid One. I

wasn't about to head for Florida, my listed alternate, even though it was supposed to be VFR. If I broke out of the weather over water, which way would I turn for land? I was ready to fly west till flameout and leave my sick bird. The United States Air Force, however, had other ideas. RAPCON told me that Donaldson AFB in Greenville, S. C., had picked me up and had started action to pinpoint me with a DF net.

Three Air Force bases had been getting DF bearing from their towers, and through Flight Service had coordinated and plotted me on a map. I gave Donaldson a call on Guard, and their reply snapped back, "Donaldson DF has you 53 miles southeast of Donaldson Air Force Base." I asked immediately for a DF steer and letdown to Donaldson. I was worried about the little Guard transmitter, but it never wavered during any of the DF transmissions that followed. GCA picked me up on final approach and brought me down, through an 800-foot overcast to a landing in the rain on Donaldson's runway.

This was one of those flights when you learn things. Among a few score other things, I learned that those seven words, "We have you in positive radar contact . . ." are the seven most beautiful words in our language.

1/Lt. Joseph P. Smith

Shaw AFB, S. C.

WRONG RAILROAD

I HAD JUST gotten my student permit signed by my instructor for cross country flights, and I wanted to try my new wings on a long trip.

On a hot summer day I left Nashville for Huntsville, Ala. I stopped over at Chattanooga for a while in the terminal building to have a cup of coffee and talk to an old friend. When I looked at my watch it was ten minutes before a luncheon engagement I had in Huntsville. I hurried to my plane.

It was gassed and soon I was on my way. The second leg of the flight caused all the trouble. I looked at my chart to find my position. Mentally noting my check points, I put the map away into the pocket in the door—my big mistake.

As time passed, I became tense over being late. I looked down and saw a check point. Right on course! The points came in line; the last one before Huntsville was a railroad leading to town.

How could you miss a big town like Huntsville? All I had to do was to follow it to my destination.

I did not look at the compass. Huntsville and the airport were only 15 minutes away. But I had missed the town and was lost.

When I looked at the compass I found I was headed north when I should have been going west!

Being in a hurry at Chattanooga, I had not noticed that the railroad had double tracks, not single, and followed the wrong track. This time the map remained on my knee.

Turning south, I was over the airport at Huntsville within a half hour. I took my time to get to that luncheon.

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Flying Safety

(Continued from page 51)

unabated, the USAF combat potential, in terms of men and machines, would be a slim fraction of what it is today.

It was not until World War II that the seriousness of accidents suddenly became widely recognized, and the USAF's organized safety effort was born at the height of the war. Reports actually showed that more pilots and planes were being lost in flying accidents, many here in the States, than to enemy action. As a result, Gen. H. H. Arnold directed the establishment of a safety organization. Now both the requirement and authority to carry on safety programs are covered by legislation, executive order, and by Defense Department and Air Force directives.

At Headquarters level, the Air Force has The Inspector General (Lt. Gen. Joseph F. Carroll) whose office is in Washington and who reports directly to the Chief of Staff. As his Deputy for Safety, I am responsible for developing Air Force Safety Requirements and Programs for all areas—ground, flight, missile, and nuclear. I have an Assistant for Ground Safety, and Directors of Safety for Flight, Missile and Nuclear respectively as my subheads.

This is a relatively new organization which moved from Washington last August, but is now operating primarily at Norton AFB, California and Kirtland AFB, N. M. as Pentagon field extensions, and it has been designed to insure that the wealth of experience gained from our flying and ground accident prevention experience is applied to missile and nuclear problems. As a matter of fact, the Air Force safety organization has always been a dynamic one, changing with changing equipment and shifting problem areas.

From this top-level safety organization down through the major air commands, and subordinate commands to the wings and bases, there are similar safety offices of varying sizes and make-up as the mission requires. In fact there are 2,094 persons in the USAF whose primary duty is safety. These are the full-time safety officers and their staffs. There are about 1,500 officer personnel who have a part-time or additional duty assignment in safety functions. One of the basic tenets of the program is that safety is everybody's business, but it is the responsibility of command—an integral part of management. One of the points a commander is rated on is his ability to operate safely. He can lose his command and his career overnight as a result of an accident that could have been prevented by proper supervision.

A safety program begins in the philosophy that accidents can be prevented, that a zero accident rate should be the true goal.

As this is primarily dedicated to flying, I intend to concentrate on flying safety, that portion of our safety effort headed by Brig. Gen. Walter E. "Pop" Arnold, director of Flight Safety Research. I must point out, however, that with the advent of atom bombs and missiles we are shifting much of our emphasis into these two dynamic and far reaching areas.

The basis of any accident prevention program is a body of factual knowledge. This takes the form of a compilation of past accident cause factors—all the things which have broken, all the design, fabrication, maintenance and operational errors, all the supervisory mistakes which have been connected with accidents. A thorough system of reporting and recording accidents and the details of their cause factors as revealed by expert investigation is an essential part of the program. That is why the Office of the Deputy Inspector General for Safety maintains the most complete file on aircraft accidents anywhere in the world. It actually includes the very first military air accident in United States history, when Lt. Selfridge was killed and Orville Wright broke his leg at Ft. Myer, Virginia, in 1908.

EVERY accident is investigated and a carefully documented report of evidence and testimony prepared. Cause factors disclosed by the investigation oftentimes lead to modifications in our equipment, changes in training programs or operational procedures and the like, all with the end in mind of preventing similar accidents in the future. An aircraft accident investigation sometimes produces valuable by-products or unrelated benefits.

For example, during the investigation of a B-58 accident a few months ago, it was found that the nosewheel landing gear attachment had separated from another mating part as a result of the impact of the crash. But an unusual fracture was observed and further investigation revealed metal fatigue. The nose landing gear played no part in this particular accident; it had been examined simply because all fractures and separations are examined dur-

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ing an accident investigation. Because failure of the nose gear on takeoff or landing could cause a serious accident, however, the Directorate of Flight Safety Research asked that the entire fleet of B-58s be inspected for signs of fatigue in this area. Three similar fittings were found to have fatigue cracks. Three aircraft, costing the taxpayers over $23 million each, might have been lost if this discrepancy had not been discovered in the course of our investigation.

The Office of the Deputy Inspector General for Safety also participates in the design and development of Air Force equipment to insure that safety factors are included on the drawing board and as the fabrication proceeds, that previous designs known to have contributed to accidents in old equipment are not incorporated in new. We carry on continuous liaison with contractors and manufacturers in an attempt to keep safety standards high and to disseminate preliminary accident information to designers and builders. As a matter of fact, there are 10 factory representatives permanently assigned to the Directorate of Flight Safety Research.

Perhaps the most potent tool in accident prevention is the Operations Safety Survey. Such surveys are conducted by teams of our experts, who go into a base and analyze the entire operation from a safety point of view. Highly trained and following carefully prepared checklists, these teams can uncover dangerous practices, unsafe conditions, lax supervision, and other deviations from safe operations procedures and bring them to the attention of command.

For example, the facilities member of one such team noted a drainage pit sticking up about 18 inches above the ground. His recommendation that this be made flush with the surrounding area was acted upon immediately by the commander. A few days after completion of the work, a bomber without brakes rolled over this pit. Had it not been lowered, the aircraft would very likely have suffered major damage, if not destruction.

Education is of course an important part of the USAF accident prevention program. No matter how much is known about accident cause factors at the headquarters level, not a single accident will be prevented unless the right people down the line get the word and are sufficiently impressed with it. In addition to directives, bulletins and messages, the Office of the Deputy Inspector General for Safety publishes two monthly magazines, special study kits for safety officers, and a variety of miscellaneous studies and posters. In all, we distribute worldwide well over 100,000 pieces of literature each month. Our film safety program has produced over 15 pictures and another 150 are scheduled. Finally, the education program includes formal safety courses at the university level.

The remarkable reduction in the Air Force aircraft accident rate has not been coincidence or good luck. The supreme mission of the United States Air Force is to prevent war—or failing this to prevail in war if one should occur. The first thing we must do is accomplish this mission. But the next thing we must do is accomplish that mission as safely as we can. We can afford no other course. END

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FLYING CALENDAR

April 9—East Coast Flying Service of Martinsburg, W. Va. (Municipal Airport) Fly-in for 1961 model display.

April 10-14—Federal Aviation Agency's first Annual International Aviation Research and Development Symposium at Atlantic City, N. J. U. S. and foreign aviation representatives will attend. Purpose is mutual exchange of aeronautical technical progress. First four days devoted to presentation of technical papers and panel discussions; fifth day to a tour of Bureau of Research and Development facilities.

April 12—Gen. William E. Mitchell Award Dinner, Waldorf-Astoria Hotel, New York. Aviators' Post No. 743 presentation to C. R. Smith, president American Airlines.

April 12—Symposium on the history of airpower at Duke University, Durham, N. C., sponsored by National Security Seminar; conducted by Duke U. and the University of North Carolina.

April 14-16—Annual Aviation Education Conference, La Fayette Hotel, Long Beach, Calif., by California Aviation Education Assn.

April 15-16—Annual Florida Spring Fly-in, Albert Whitted Airport, St. Petersburg, Fla., sponsored by Experimental Aircraft Assn., Chapter 47, Tampa Bay Area. Contact L. E. Lee, 1604 Maple Ave., Tampa 4.

April 19-21—Southwestern Institute of Radio Engineers Conference & Electronics Show, Dallas, Tex.

April 22-23—Annual Sportsman Pilots' Navigation Contest, Miami, sponsored by Florida Air Pilots' Assn. Contact: R. L. Reinecker, 123 N.E. 23rd St., Miami.

May 1-5—Aviation/Space Writers Assn. annual meeting and news conference, New York, N. Y. Headquarters: Commodore Hotel. Committee chairman, Ansel E. Talbert, % Flight Safety Foundation, 468 Fourth Ave., New York 16, N. Y.

May 3-5—American Helicopter Society annual Forum, Sheraton Park Hotel, Washington, D. C.; will include a trade show.

May 8-10—Annual National Aerospace Electronics Conference, Dayton, Ohio.

May 12-14—North Central Section of the Ninety-Nines, Inc. Spring Sectional meeting, Paradise Inn Motel, Champaign, Ill. Hostesses: Central Illinois Chapter.

May 27—All Woman's International Air Race, Lehigh Acres, Fla., to Nassau, with stops at Grand Bahama, Eleuthera, Harbour and Great Abaco Islands. All women pilots with private licenses eligible. Contact: Mary Barrer, Florida Women Pilots' Assn., Inc., Suite 508, First National Bank Bldg., Miami, Fla.

June 2-3—Reading's annual National Maintenance and Operations Meeting, municipal airport, Reading. Pa. Contact C. J. Melville, Reading Aviation Service, Inc.

Calendar items must be received by FLYING's editorial office, 1 Park Avenue, New York 16, N. Y., two months prior to the event.

Cavalier 2000

(Continued from page 39)

Rolls-Royce Merlin fires two or three times, you can push the mixture lever into NORMAL. There is a RICH position on the quadrant, but it is used only in case of suspected fuel system difficulties. The engine has a deep, rather unusual roar, characteristic of all Mustangs.

The 1495-hp V1650-7 Merlin is cooled by a Prestone-water mix, and this makes necessary the only unusual engine operation feature in the Cavalier. When the airplane is on the ground, the coolant radiator and oil radiator exhaust flaps must be in the full open position to maintain a comfortably cool engine. On takeoff, the switches for these flaps are placed to AUTO, and a thermostat takes over the job of keeping the coolant and oil temperatures in the green.

As with most conventional-gear airplanes, forward visibility during taxi is not one of the Cavalier's strong points; as I taxied out with Mason Armstrong, Trans-Florida sales manager, it was necessary to S slightly to keep a clear picture of aircraft in front of us.

With the control stick held aft of neutral, the tailwheel steering is engaged and the tailwheel will turn through a 12-degree arc. For sharper turns, the stick must be moved full forward, disengaging the steering and leaving the wheel free to turn in any direction.

Idle rpm was quite sufficient to keep the evaluation Cavalier rolling along at a comfortable pace.

Engine runup was also a simple matter. Magnetos are checked at 2,300 rpm, the propeller is cycled, and the supercharger is pressed momentarily to HIGH. A drop in rpm indicates that the supercharger is working properly, and that's it; the airplane is ready for takeoff.

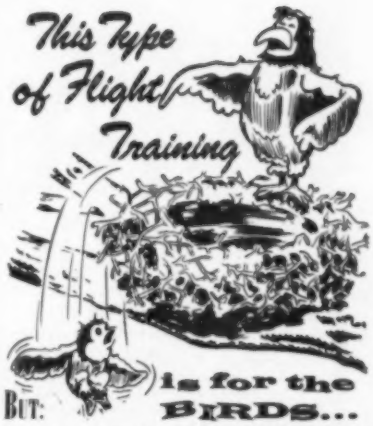
I pushed the coolant and oil flap switches into AUTO as we took the active runway at Sarasota-Bradenton Airport, and rechecked the rudder trim at six degrees right.

I had heard more than one rumor that the Mustang is a flying torque machine. I'm still trying to remember the name of the fellow who told me that, and when I do, I'm going to call him up and tell him it just isn't true. On a normal no-flap takeoff from Sarasota (elevation 20 feet), into a five-mph headwind, the Cavalier lifted off the ground in a shade more than 1,300 feet. Torque was not even noticeable. I held takeoff power at 61 inches mp and 3,000 rpm only till the aircraft was safely airborne and the gear was on its way up. Then I pulled the power back to METO (maximum except takeoff), 46 inches and 2,700 rpm.

The Cavalier does not pussyfoot or wait to show you her speed. A second after the gear tucked itself up and the red 'unsafe' light blinked out, we were indicating 200 mph and passing through 500 feet. Holding 200 mph, rate of climb showed 2,000 fpm.

As I eased the stick back to hold 175 mph, the rate of climb pushed to a bit over 2,500 fpm; the company calls it 2,550 fpm. The 175-mph climb attitude is a little steep, and if you don't mind spending five min-

(Continued on page 104)



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(Continued from page 103)

utes to get to 10,000 feet, the 200-mph figure gives a more comfortable flight attitude.

For the first four or five minutes of my first flight, I was thinking behind the airplane. It took about that long to get used to the idea that this is no tired transport when it comes to airspeed.

When you fly the Cavalier, you quickly learn the real meaning of an old word. Trim. If you are going to make friends with this airplane, you must learn to play those three trim control wheels as an organist plays the stops of a three-manual console. For every change of power, for every change of airspeed, your left hand must be flicking over those trim wheels. It is such a necessary thing to fly the airplane smoothly that it becomes second nature very quickly. With the three-axis trim you can hold the airplane in any flight attitude you want, and very precisely. Without the trim, you fight the airplane and she fights you.

Shortly after I levelled at 5,000 feet, I realized that something had happened to the visibility. The long nose had dropped away where it belongs, and the Cavalier showed me that her flight visibility is more impressive than the widest motion picture screen. There is no uncomfortable feeling of someone sneaking up behind the airplane; turning your head, you can see every bit of blue the sky holds except for a vertical strip a tenth of a degree wide blocked by the vertical stabilizer. This is a selling point that Trans-Florida didn't stress enough in

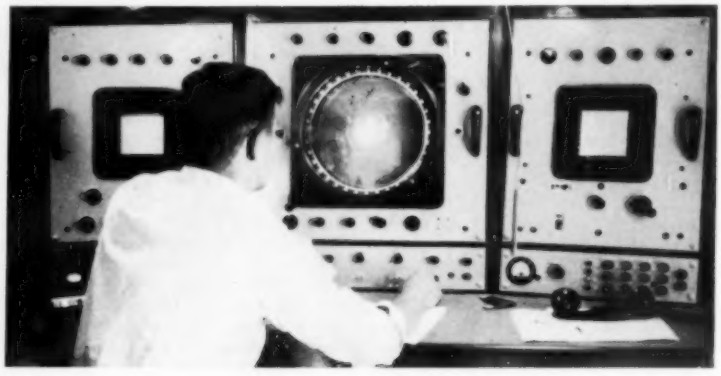
CAVALIER 2000

Specifications:

Span	40 ft. 1 in.
Length	32 ft. 2 in.
Height	12 ft. 2 in.
Wing area	272.3 sq. ft.
Tread	11 ft. 2 in.
Crew/passengers	1/1
Baggage capacity	400 lbs.
Weights:	
Max. takeoff	10,500 lbs.
Max. landing	8,500 lbs.
Empty	7,121 lbs.
Useful load	3,379 lbs.
Fuel capacity	376 gal.
Oil capacity	12.5 gal.
Engine: Packard-built Rolls-Royce Merlin V1650-7 with 1,495 hp at sea level, 1,595 hp at 15,000 ft. Fuel grade 100/130.	

Performance:

Maximum speed	490 mph
Cruising speed (optimum altitudes):	
METO	424 mph
Normal	370 mph
Economy	316 mph
Miles per gallon at normal cruise	5 mpg
Range	2,000 miles
Service ceiling	40,000 ft.
Glide ratio	14:1
Initial rate of climb (METO)	2,550 fpm
Takeoff distance	1,050 ft.
Landing distance	925 ft.
Stall speed:	
Gear and flaps up	101 mph
Gear and flaps down	86 mph



FLIGHT WATCH

MOST LIGHTPLANE accidents involve weather. Pilots have flown from small fields, without weather briefings, to find their destination airport buried in weather; they have been caught in rapidly deteriorating weather en route and forced to land on emergency runways or on no runways at all. In many accidents, the airplane was forced down because the pilot simply did not know what kind of weather he was flying into.

The Federal Aviation Agency's solution to the problem went into effect on October 15, 1960. The agency has established a flight following service which provides a continuous survey of en route and destination flight conditions for VFR lightplane flights lasting longer than one hour, and which is available to any pilot who requests it.

A pilot who requests VFR flight following receives a thorough preflight briefing on current and expected weather conditions, en route and at destination. He receives all available weather advisories and forecasts, and notices on the status of navigational aids and conditions of the destination.

There are some requirements. The airplane must have a two-way radio. The flight must be along a route that enables a number of flight watch stations, about an hour's flying time apart, to be selected nearby. Each of these stations receives the pilot's flight plan, and computes the time that the flight should be over the station.

When the pilot is airborne, he reports his off-time to the departure station, and the flight watch is underway.

Each of the flight watch stations, in turn, is responsible for the safety of the flight until it has passed, and the responsible station monitors the weather and status of navigation aids ahead of the flight. The pilot is advised promptly of any hazardous developments, either by the flight watch station, or through the nearest information station. Thus the pilot knows immediately of any severe weather, such as prefrontal squall lines along the route, or lowering ceilings and visibility which might cause him to divert to an alternate.

Each flight watch station prepares a flight condition message shortly before the pilot calls. Selected current weather reports and PIREPs also are given to the flyer.

At this point, pilots are requested to give a report of the flight conditions which they have observed over the last segment of the route.

The pilot is required to contact each of the flight watch stations along his route. If the pilot fails to make his report, the station checks back along the route to determine where he reported last. A communications search is made in the area where the pilot might be. If this fails to provide information on the plane, and if the plane is not found at one of the airports in the area, search and rescue procedures are begun.

Pilots not using the flight following service are given weather or navigational information on request, and advisories on hazardous conditions affecting their flight are volunteered by stations. All pilots should, as a habit of good operating practice, give position reports and pilot weather reports to all stations along the way, whether flying on a flight plan or not. If search and rescue operations are necessary, these position reports will narrow the search area.

The VFR flight following service is one of several programs enabling stations to provide better service to the general aviation pilot. Station personnel are receiving training in weather briefing, administered by the Weather Bureau, which will have the effect of nearly tripling the number of briefing counters over the country where personalized weather briefing can be obtained.

A good way for pilots to become familiar with the new services is to ask for "VFR flight following." They'll get the full treatment.

—Clyde E. Brown

their brochure; I haven't yet flown the business airplane with visibility as good as the Cavalier's.

At 5,000 feet and normal cruise power of 36 inches mp and 2400 rpm, our airspeed settled at 265 IAS, or 294 TAS. I pushed the power to METO, trimmed the airplane, and the airspeed needle stabilized on 280 mph, which was 312 mph TAS.

We climbed on up to 7,500 feet, a good altitude, Armstrong said, to practice stalls. This is where I expected trouble from the Cavalier, and this is where I got a pleasant surprise. With gear and flaps up, a light buffet begins tapping on the stick at 105 mph. At 101 mph the airplane stalls, with a quick break and a gentle roll to the left. The Cavalier recovered the instant I let the stick forward, and a touch on the rudder brought the wing back up. Turning stalls showed the same light buffet and the same quick recovery. Gear and flaps down, the airplane flew a repeat performance of her clean stall characteristics, except that the airspeed read 86 mph when the break came.

In slow flight, gear and flaps down, the Cavalier took 25 inches mp and 2,700 rpm to maintain level flight at 100 mph. At this airspeed the ailerons are still very responsive, and I rolled quickly from a 30-degree left bank to a 30-degree right bank without a shudder.

"I thought this was supposed to be a red-hot fighter plane," I said to Armstrong on the interphone. "Where does it get the pussycat stall?"

"It's always had the same stall," he said. "Our biggest problem is to convince people that the Cavalier flies just like any other airplane. At a fly-in at Vero Beach, we flew the pattern behind an Aztec and a Comanche. Some people on the ground asked us why we didn't fly a high-speed military approach, and we had to tell them that the Cavalier is not a military airplane."

Though she no longer wears her war paint, the Cavalier keeps her redline airspeed high on the dial at that 490 mph IAS, and has a maximum cruise airspeed of 424 mph TAS at 30,000 feet and METO power. You pay for this by using 94 gallons of 100/130 per hour. For economy cruise, to limit fuel consumption to 32 gallons per hour, you can pull the power back to 26 inches mp and 1,800 rpm and still be indicating 210 mph, or 249 mph TAS.

We climbed on up to 10,000 feet, leveled at normal cruise, and I read 251 on the airspeed indicator, just 300 mph TAS. METO power at 10,000 feet gave us 330 mph TAS, and watching the ground flick by under the leading edge of the right wing, I could believe it. You get used to handling the airplane's speed quickly, but it takes longer to realize that checkpoints actually are going by as fast as they are.

Cruising over the west Florida coastline, the Cavalier showed off her quality as a cross-country airplane. Dual omni makes this airplane very easy to navigate. With the twin VOR sets tuned and the Dare ADF humming quietly to itself, we had a constant three-station fix on our position; it was a very comfortable feeling. Another feature of the Cavalier is its Sperry non-tumbling attitude indicator and gyrosyn compass. Though the airplane is the business

(Continued on page 106)

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HELICOPTER INDUSTRY ON THE RISE

THE GROWTH of the helicopter industry to a million dollar-a-week enterprise during 1960 set the tone for the 13th annual Convention of the Helicopter Association of America at Haddonfield, New Jersey.

Manufacturers and operators alike spoke optimistically of the continuing trend toward wider acceptance of helicopter services. Operators estimated that 57 different types of services performed in the United States and Canada (not including military operations or the activities of the three major helicopter airlines) are doing a $50 million-a-year business.

Commercial helicopter operators in the United States and Canada now total 245, and fly 900 rotorcraft. This represents a 37 per cent expansion since 1957, when 120 companies operated 520 helicopters.

The average operator has a total employment of about 22 and serves 850 different customers a year. This gives an estimated industry total of 127,000 customers and 3,372 employes. The data was presented by Welch Pogue, counsel to the Aerospace Industries Association's Helicopter Council.

The HAA, organized to speak for the commercial helicopter operators in the western hemisphere, presented a well-rounded program designed to aid and educate its members and to give them a sounding board for their own ideas.

Over the four-day span of lectures, movies, forums and displays, some highlights were:

- Discussion of the creation of a sound policy to govern all helicopter operations. During an open forum the FAA and HAA set the wheels in motion for a cooperative method of establishing regulations. The fact that there are inadequacies in the existing regulations was quite evident during the discussion as questions on interpretation were constantly at issue.
- The presentation of Pilot of the Year award to Danny Carlson, S-58 pilot for Petroleum Helicopters, who is credited with saving over 100 lives when Hurricane Donna struck the island of Puerto Rico.
- The acceptance of the Lawrence D. Bell award by John Hunter of the Air Transport Board of Canada marked the completion of ten years of continuous helicopter operation.
- The election of Hal Connors as HAA's new president and the stepping down of Robert L. Suggs, President of Petroleum Helicopters. Mr. Connors is the general manager of Helicopter Airlift.

With close to 300 representatives from almost every phase of the industry in attendance, speakers pointed up the coming of age of the helicopter.

When next year's meeting is opened in the Dallas-Fort Worth area expectations are that the growth of the industry will continue toward a better realization of the helicopter's truly vast potential.

A. C. BASS

(Continued from page 105)

tool that Trans-Florida says, it is licensed for all acrobatics except snap rolls and power-on spins and is stressed for an ultimate load of nine Gs at its 10,500-pound maximum gross weight. It is conceivable that the non-tumbling gyros could prove their worth in both VFR and IFR flight.

One other nice feature on the instrument panel is the instantaneous vertical speed indicator, which is just that. The six- to nine-second lag of the earlier instrument has been eliminated and you know your rate of climb and descent every moment of flight.

President David Lindsay has very definite ideas about the place of his airplane in the aviation world. "We're not in the business of selling war trophies," he said to me.

"We are offering the Cavalier as a very fast business aircraft that any businessman-pilot or company pilot can fly. It can be an only airplane or it can be the high-speed part of the company fleet. I discovered that four-place company aircraft often fly with one or two seats empty, and that often only one executive is required to handle long-distance business problems. I'm not wor-

ried that the Cavalier's two-place seating will disqualify it for many companies."

With a low-pressure oxygen system, the Cavalier introduces what could be a new concept of flight to many pilots of conventional business aircraft; its 40,000-foot service ceiling makes over-the-weather flying a very practical thing. It was this capability, in fact, that led to David Lindsay's decision to remanufacture the Mustang for executive use. "Summers in Florida bring afternoon cumulus buildups that are simply too high for conventional business airplanes to fly over," he said. "Going around them at low speed is a time-consuming process and going through them, for me, is unthinkable. The Mustang could top all but the tallest thunderstorms, and could detour those tall tops at a speed that could put me where I was going in a reasonable time. I decided that this airplane would be a very useful business tool, and the Cavalier idea was born."

When it comes to flying over the weather in his single-engine business plane, Lindsay is emphatic. "I'd much rather be on top of the weather behind one Rolls-Royce Merlin than in it with any number of engines," he said.

At 25,000 feet, when you push the supercharger switch to HIGH, the Cavalier becomes a new airplane. Her METO power rate of climb lifts you up at 1,150 fpm, and at 35,000 feet her rate of climb is still 500 fpm. If you want to get over a tall top in a hurry, you can go to take-off power, and at 25,000 feet, climb at 1,600 fpm. Takeoff power at 40,000 feet still gives a 450 fpm margain to maneuver with.

Except for a slight ram effect of the ventilation system, the cabin is not pressurized, and at altitudes above 32,000 feet you must dial the regulator to breathe oxygen under pressure.

Descent is another interesting area of the Cavalier's operation. With the propeller lever at full increase, you can point the nose of the airplane almost straight down and still not exceed the 490 mph redline airspeed. At very high airspeed the controls become rather stiff, though not unmanageable. A little bit of trim at these speeds has a tremendous effect, as I discovered when I spun the elevator control wheel at 405 mph. I was smashed down by G forces before I could blink, and learned right away to turn the trim wheel slowly.

ONLY through mismanagement of this thoroughbred Mustang can her operator become involved in problems, and then after the airplane has forgiven him once or twice. Prolonged operation of the supercharger in HIGH when on the ground can hurt any supercharged engine, and the Cavalier's Merlin is no exception. Coolant and oil temperatures can go soaring right on over the redline unless the radiator exhaust flaps are full open for ground operation, and the Cavalier has a green COOL light on the instrument panel to indicate open flaps. Even with the worst mismanagement, though, the engine won't explode or suddenly stop running due to internal failure. When the Merlin has been abused to the point of failure, Armstrong said, tiny cracks develop in the cylinder head, and coolant leaks into the cylinders. This shows as white smoke from the exhaust stacks and gives the pilot a firm indication that all is not well with the engine.

It is not difficult to operate the aircraft correctly, and I can echo Lindsay's words, "Managed properly, the Cavalier is a complete lady in the air."

This takes a demonstration to learn, for it is difficult to overcome the feeling that Trans-Florida's airplane, which was, after all, a fighter airplane, is only for supermen to fly. The best part of the demonstration is the landing. We turned onto downwind at Sarasota-Bradenton indicating 150 mph, a comfortable speed with no other aircraft in the pattern. Flaps go down to 30 degrees. When you lower the landing gear lever, the red 'unsafe' light comes on for a moment and you hear the clunk clunk of the main gear locking down. I was told that you can feel the tailwheel come down, too, but didn't notice the sound or vibration it made. The green light comes on when the main landing gear are locked, and you turn to base leg, slowing to 130 mph. The surprising thing about the pattern was that it was quite normal. I turned on to final approach, lowered the flaps to their full 50-degree DOWN position, and let the airplane slow to 120 mph. Final approach visibility is excellent. We had 105 over the fence and began the flare to three-point attitude, and the good aileron response at low airspeed made itself known. I started a go-around just before we touched down, and

(Continued on page 108)

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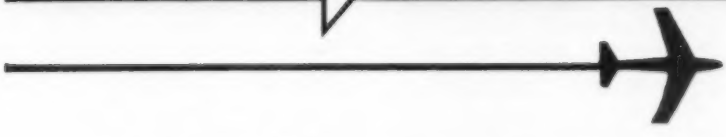

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(Continued from page 107)

waited for that rumored torque. It was there as the throttle came forward, but made itself known as a tendency to skid rather than roll the airplane. Two turns of the rudder trim wheel erased the skid. We levelled, flying along the edge of the runway, and I raised the gear. In a moment I brought the flaps up, a ten-degree notch at a time.

The next landing was a full stop. The touchdown was not as smooth as I would have liked, for the Cavalier does not have the whipped-cream landing gear of some airplanes, and we rocked from side to side for a few seconds on the solid struts. I was waiting, a little nervously, on the rudder pedals, for I had heard that the Mustang was a ground-looping airplane. I should have saved myself the trouble of worrying. The 11-foot two-inch tread of the landing gear is wide enough to let the airplane roll straight down the runway with very little help from pilot. The nose was up again and I S'd during the last few hundred feet of the roll to keep an eye on the end of the concrete.

Trans-Florida calls for a 1,750-foot landing roll over a 50-foot obstacle and a 925-foot roll with clear approaches. I'll take their word for it; we used about 2,500 feet and very light braking action at the end of the roll, turning off at midfield. You taxi with the flaps up in the Cavalier to keep from having rock-dents in them aft of the wheels. It wasn't hard for me to remember to hold the radiator exhaust flap switches to OPEN for a few seconds; that had been particularly stressed in my checkout. "I've held on the ground for forty-five minutes on a September afternoon in Miami," Lindsay told me, "and never had a bit of trouble with the coolant temperature. There is very little chance of staying under the redline, though, if you taxi for long with the radiator flaps closed."

I had a tendency to overshoot my taxiing turns with the tailwheel steering disengaged, and learned that you have to lead the rollout point of the turn by quite a margin to make a sharp turn into a precise heading on the taxiway.

Back on the ramp at Trans-Florida, I let the engine idle for a moment at 1,500 rpm, then brought the mixture lever back to idle cut-off. The big strange-sounding Merlin died as if she had been shot through the heart, and I felt a little like a murderer. The canopy cranked easily back and we stepped to the ground.

Bill Brownell, vice-president of the company, showed me through one of their three parts warehouses.

"We can air express any part of the airplane, in FAA certified overhaul or new condition within a day after we get the order," Brownell told me, and after seeing just that one warehouse, it was not at all difficult to believe. The walls were a frozen waterfall of parts, the floor a carefully placed sea of them. In the midst of this labelled and tagged ocean of steel and aluminum stood a Merlin engine, with zero time since major overhaul. It costs $3,000 at Trans-Florida, and I counted 32 engines in sealed cans and crates outside the hangars. Tiptanks (which can jettison their fuel in three minutes of flight) are stacked in crates to make a mountain 15 feet high and 60 feet long next to the engine containers.

With each airplane comes a flight manual, a 490-page maintenance manual, canopy and airscoop covers, and a pilot ground school and checkout program. Even with photographs saying their thousand words, the appearance of the Cavalier cannot go unmentioned. It is a very pleasant, very bright feeling to walk out to that extremely attractive airplane, spin the big Merlin into her strange-sounding roar, and taxi to the active runway. The Cavalier turns heads and draws crowds wherever it lands, and I even noticed several motorists stopped in their automobiles along the edge of the road by Trans-Florida's hangar looking at the Mustangs parked on the grass.

Those motorists have the key to the whole Cavalier story; the airplane is as enjoyable to fly as it is to look at. With the Cavalier 2000, that is saying a great deal indeed. END

FLYING CESSNA'S NEW 310F

CESSNA'S 310F features slimmer lines through sharper fuselage and tip tank nose sections. The 1961 color schemes further accentuate the slim look.

Two additional rear windows improve cabin visibility, especially for the fifth seat passenger, an optional arrangement.

The 310F flown by FLYING from the Cessna airport was equipped with the optional Motorola L-2 autopilot with altitude control and approach coupler. During the flight the system was locked on to the Wichita VOR and smoothly guided the plane to the station.

Transition was made to the ILS for an automatic approach; azimuth control was good throughout, but half way between the middle and the outer marker some overcontrol was experienced on the glide-slope. The nose hunted up and down several degrees. Approach accuracy was quite satisfactory for a minimum ceiling and visibility approach.

A manually flown ILS revealed the fineness of control and stability of the 310; directional control was good. With quarter flaps, gear down, 2,450 rpm and 20 inches mp, an IAS of 120 mph resulted; reducing the power to 15 inches mp and maintaining the airspeed resulted in an exact 500 fpm descent—the approach was terminated at 100 feet.

Landings made at the Wichita municipal airport were with 11 inches mp at touchdown. According to Oliver Hopkins, Cessna sales representative, this results in a smoother touchdown. Hopkins said the 310 has a higher wing loading than the WW II P-39 fighter. Landings easily were accomplished with these power settings although there was some float with a 100-mph glide speed.

With a 4,200-pound gross weight at 8,000 feet, 70 per cent power resulted in 205 mph IAS; with zero degrees Centigrade outside air temperature this trued to 231 mph—six mph over advertised airspeed for this condition.

One propeller was feathered and with 70 per cent power on the operating engine, 135 mph IAS resulted; with this power setting at 8,000 feet, the 310 could still climb at approximately 100 fpm. Control was good and turns could be made in either direction with no loss of altitude.

Interior of the airplane is plush: wool fabrics interwoven with metallic strands and bounded by genuine leather make up the upholstery; floor covering is deep pile wool carpet. The excellent instrument panel of the D model with the radio panel in the center for ease of tuning is retained. One minus feature—the manifold pressure gage is too far from the flight group for good power control—it is to the right of the radio panel.

Returning to Cessna's 2,300-foot runway 17, with a 45-degree, 15-knot right cross-wind, we crossed the fence at 90 mph and closed the throttles; touch-down was easy and we rolled out without the use of the brakes.

Basic price of the 310F is $62,500.

GERALD J. SCHLAEGER

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1957 Cessna 182, #3844D, Full panel, Narco MII omnigator ADF, 50 hrs. SMOH, New license. Private Party. Richard T. Moss, 16041 Ventura Blvd., Encino, Calif. P. P. $10,500.00.

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Classified

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ADVERTISERS INDEX—April 1961—Flying

ADVERTISER	PAGE
A C Spark Plugs	73
Academy of Aeronautics	86
Acme School of Aeronautics	105
Aero Commander, Inc.	55
Aero Products Research, Inc.	76
Aero-Progress, Inc.	72
Aero Publishers, Inc.	82
Air Age Accessories	106
Air Associates, Inc.	2nd Cover
Air Products Company, Inc., Aircoupe Div.	84
Aircraft Radio Corporation	15
Aircraft Specialists, Inc.	64
Airline Operations Training, Inc.	106
American Airlines	21
American Flyers, Inc.	107
Bahamas Development Board	90
Beech Acceptance Corp.	1
Bendix Products Division	57
Brantly Helicopter Corporation	68
Cessna Aircraft Co.	4th Cover
Champion Spark Plug Company	59
Collins Radio Company	9
De Havilland Aircraft, Inc.	11
Don Juan Watch Bands	86
Dot Airtronics	91
Douglas	17
Edo Corporation	90
Electric Autolite Company, The	80
Electric Storage Battery Company	61
Embry-Riddle Aeronautical Institute	70, 89
Esso Standard, Division of Humble Oil & Refining Company	67
Fidelis Wholesalers	102
Flying Book Service	97
Fowler-Aero Publications	92
Fram Corporation	65
Graubart Aviation, Inc.	102
Gulf Aviation Products	87
Holiday Inns of America, Inc.	14
Indiana Technical College	106
Jeppesen & Co.	79
Kane Aero Equip't	88
King Radio Corp.	85
Lake Aircraft Corp.	18
Lane Aircraft Company	63
Link Aviation	75
Manger Hotels	62
Mooney Aircraft, Inc.	101
National Aeronautical Corp.	19
Navion Aircraft Company	13
Nelson Specialty Corporation	64
Northrop Institute of Technology	6, 78, 93
Nova-Tech, Inc.	64, 98
Pan American Navigation Service	16
Parks College	66
Phillips Petroleum Company	71
Piper Aircraft Corporation	7, 60, 69
Pratt & Whitney Aircraft	83
Puritan Equipment Inc.	10
Renault, Inc.	3rd Cover
Riverside Records	12
Ross Aero Publishers	103
Ross School of Aviation	103
Sanderson Films	100
Schweizer Aircraft Corp.	76
Scott Aviation Corp.	4
Shinn Engineering, Inc.	81
Southwest Airmotive Co.	12
Spartan School of Aeronautics	99
Standard Oil Company of California	77
Tactair, Incorporated	5
U. S. Air Force	95
United Air Lines	96
Weems System of Navigation	74
Westair	98
Whitted Airport, Albert	86
Wood Brothers Mfg. Company	76
Zahns Airport	91

BRIEFINGS...

(Continued from page 8)

makers with problems peculiar to various portions of the state; (2) to present first-hand knowledge of the state's aeronautical needs, and (3) to give them an opportunity to see how and where the dollars for state airport aid were being spent. The Arizona FFs take pride in this tour as a "first of its kind."

Mooney Aircraft's president Norman Hoffman reports that since the company introduced its all-metal Mark 21 model in mid-December, orders have been received for 150 of the new 180-hp., single-engine, four-place planes. This represents a dollar volume of more than $2,500,000, approximately the same as Mooney's total for 1960. The Mark 21 is being produced at the rate of one a day at present; with plans to up this to two by July.

New fixed base operation has opened at North Little Rock Airport (Ark.) under name of Armisten Aviation Associates, Inc. Principals in the organization are Dr. Kenneth G. Jones, Little Rock orthopedic surgeon; Dr. Robert B. Boyson, local dentist; and Cliff Plegge, operations manager.

On loan, free of charge, to any interested pilots' group regardless of size, is an illustrated taped lecture on first aid prepared for pilots by the Flying Physicians Assn. The lecture runs approximately 50 minutes. It may be obtained through any local physician by writing to Dr. Russell J. Vastine Jr., 2026 Lake St., Niles, Mich. Two weeks should be allowed for scheduling.

Eight overhead pullman-type berths installed in Reynolds Metals Company's corporate DC-6B converts the airplane into a "flying hotel" for executives and sales personnel. Six of the berths are shown here recessed into the ceiling of the main cabin;

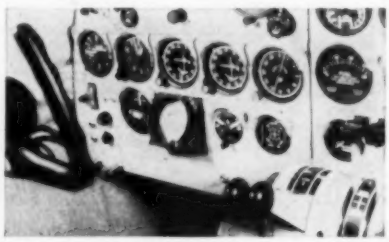
two others are in the aft cabin. AiResearch Aviation Service, Los Angeles, made the basic conversion of the 6B last year, added the berths later. For daytime flight, the plane can carry 42 passengers. With overhead berths supplementing berthable divans, in-flight sleeping accommodations are provided for 16 persons.

The first comprehensive teaching guide for an earth and space science course in the high schools is now offered for nationwide distribution by the National Aviation Education Council. Called "The Earth and Space Science Course Teaching Guide" (Cost $1.) it was originally prepared by Dr. Charles H. Boehm, Pennsylvania Superintendent of Public Instruction. To obtain a copy write NAEC, 1025 Connecticut Ave., N.W., Washington 5, D. C.

Formal agreement has been signed between Beech Aircraft and Societe Francaise D'Entretien et de Reparation de Materiel Aeronautique (SFERMA) of Seine, France, for further development and application of turboprop engine installations in Beechcraft airplanes. The new agreement includes continuation of current joint projects and marketing plans; also authorizes possible exchange of manufacturing licenses by the two firms.

East Coast Flying Service, Inc., Municipal Airport, Martinsburg, W. Va., headed by S. Ross Lipscomb, has been appointed Cessna sales and service representatives for the company's complete line of aircraft. Territory assigned covers Maryland, Virginia, Delaware, parts of West Virginia, Pennsylvania and New Jersey. An open house and "fly-in" is scheduled by ECF for April 9th.

Weather radar installation in a Model 500B Aero Commander was recently executed by Robbins Aviation Corp., at Pontiac Municipal Airport, Mich. Said to be the first installation in this model, the sys-



tem includes the RCA AVQ-50 radar along with the Chamberlain aviation radome. Included is a special three-inch indicator mount (lower center) which provides easy viewing of the scope, particularly in single-pilot operated Commanders.

Sales of Tactair T-3 automatic pilots for business aircraft were the highest for the three month period ending December 31, of any quarter in the company's history. The Tactair T-3, manufactured in Bridgeport, Pa., by Tactair, Inc., is a three-directional automatic pilot, pneumatically operated. It is approved for installation on virtually all Beech and Cessna airplanes and the Piper Apache.

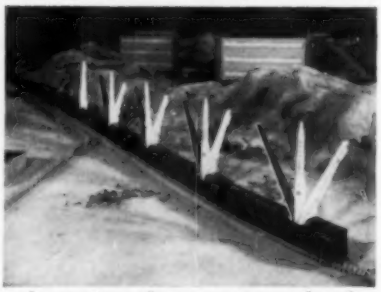
Detailed, practical, inexpensive means of becoming familiar with your airplane's airworthiness performance and flight characteristics are contained in two new Pilot's Handbooks, prepared by Harley D. Kysor, airline captain and president of Aeronautical Consultants & Associates, Inc., of 1695 Merrick Ave., Merrick, N. Y. One manual covers aircraft certificated under CAR part 3 (single engines and light twins), price $3. The second manual covers piston and turbine-powered transport category airplanes. Price $5.

To serve notice that he was open for business the developer of a Dallas industrial park recently engaged a helicopter to spray paint a "Texas-size" sign across the heart of his 1,300-acre development site. The sign, 3,240 feet wide and 1,250 feet deep,

is equal in size to 13 football fields. Each letter measures 200 x 300 feet. A spray-equipped Bell helicopter did the job, applying more than 9,000 gallons of specially-mixed whitewash. It required 150 separate flights over a four-day period.

Completion of new hangar and repair facilities at the Harry P. Williams Airport, Patterson, La., for the recently organized firm of Aircraft Specialists, Inc., signals inauguration of a new airmotive complex for private, military and executive aircraft. In addition to overhaul and maintenance, Aircraft Specialists will offer charter and freight service, aircraft leasing and flight instruction, and a complete line of parts and accessories. Dr. I. H. Saltz, prominent Morgan City surgeon, is president of A.S.I.; G. H. Nichols is vice president and superintendent of repairs.

A model train with lethal potential for any would-be sky invader of U.S. territory, this Air Force Minuteman missile train shows the missile in the "strategic alert" position with "strongback" covers open. Under ac-



tual operations, the covers open only a few seconds before launch. In background are models of transfer buildings to be located at support bases, to transfer the missiles from highway transporters to launch car.

Mohawk Airlines and Eastern Air Lines are seeking CAB approval for the transfer to Mohawk of Eastern's present authority to serve two Vermont (Rutland and Burlington) and six upstate New York Communities (Albany, Glens Falls, Plattsburgh, Saranac Lake, Lake Placid, Massena and Watertown). The transfer would increase Mohawk's route structure about one-third, or 7,000 miles daily, and move the company into No. 1 position in local feeder airline service. If approved, Mohawk will dispose of its last five DC-3s, and purchase six more Convair 440s or Martin 404s.

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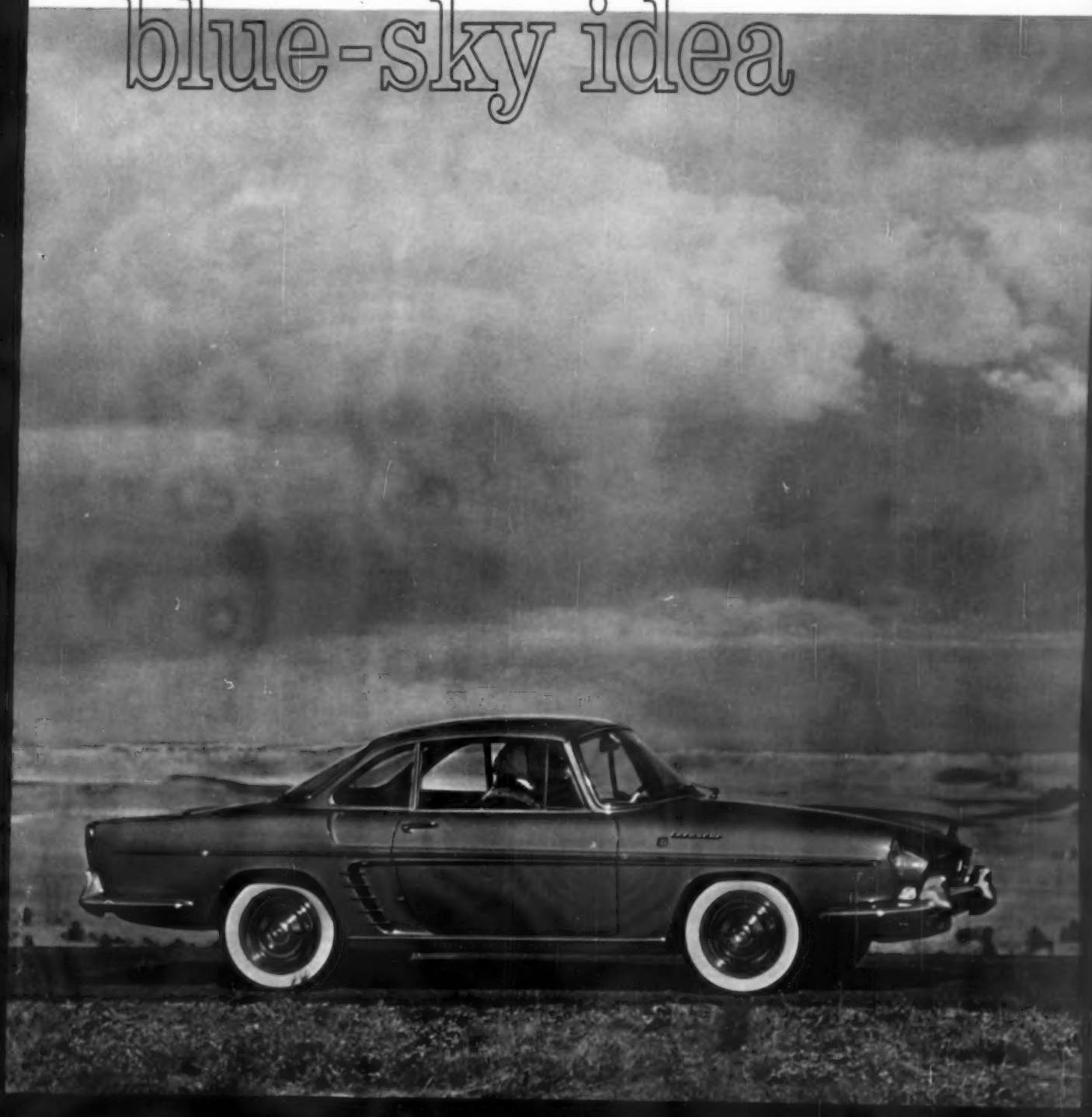

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